THE

Practical Teacher

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Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

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III.

WOUNDS—(*continued*).

IT will be all but useless to strap up or bandage a wound in which an artery has been divided; any attempt therefore to do without skilled surgical assistance would be attended with serious danger to the life of the boy. The surgeon as soon as he has made out the position of the wounded artery will enlarge the wound and place a ligature on it above and below the part injured. If it be a small artery, a ligature of the upper portion and so-called torsion of the lower may be sufficient. The lips of the wound will be brought together and treated just the same as if no ligature had been used. The cut surface may be anointed with carbolised oil, and some antiseptic lint or gauze applied and kept in its place by a bandage. It will be found that if this has been skilfully applied that there is no suppuration, so-called, that is that there is no pus or matter formed, and the wound heals by first intention (another surgical term which in effect means without suppuration), the child is well in a few days, provided the injured part is kept at rest and not allowed to be damaged in any other manner. The ligature comes away in a few days, and is no detriment to the healing process. Clean incised wounds in which there has not been any injury to an artery are easily dealt with and soon get well. If they are dirty they must be well cleansed with pure water, so that all foreign bodies (that is, all extraneous matter) may be entirely removed, then apply carbolised oil freely, bring the lips of the wound together by narrow strips of adhesive plaster, and cover up with antiseptic gauze.

Lacerated Wounds.—These never heal by first intention; the torn parts contain damaged tissue, which is sure to die, and must be removed from the injured part before the flesh will heal and the skin cicatrize; but if the laceration is not severe it may be treated as directed for contused wounds. Laceration of the fingers and toes, such as are produced by rusty nails and jagged iron on park palings and similar fences, are sometimes followed by very serious results, though the wounds themselves may not appear at first to be of much moment. Skilled assistance should be sought for in any such case, and in the meantime it is best to bathe with warm water for a short period, and then cover up from the air. It used to be a custom to push pledgets of lint into such wounds to keep them open; all these kinds of insertions are injurious: indeed, it is never right to put foreign bodies, except ligatures, in fresh wounds under any kind of pretence; bring the parts into as natural a condition as can be done, and keep them so by gentle means; all tight bandages and all closely fitting compresses are wrong; antiseptic gauze gently applied may allow of a great part of the mischief being repaired without the production of any constitutional disturbance. By the term constitutional disturbance is meant the reaction which is set up in the system after the shock of a wound of any kind. A moderate amount of local inflammation is necessary to heal a wound in every case, but if it goes beyond the locality then the action is said to be constitutional; and if increase of heat results—which is a kind of fever—it shows that the mischief has gone beyond the line necessary for the healing process to be completed. This constitutional disturbance may run high in those suffering from the effects of lacerated wounds, especially if they are so-called inflammatory subjects—that is, if they have been accustomed to take much animal food and drink alcoholic liquors. The total abstainer, if he is also temperate in the use of flesh meat, is seldom, if ever, inflammatory, and his wounds heal by the first intention in a most convenient and comfortable manner.

Sometimes a finger is torn off completely, and an enquiry is made as to the possibility of obtaining a reunion of the severed parts. Reunion in such a case is not possible; but if there is any part remaining attached it should not be separated until the surgeon has determined whether it can be saved or not. A small attachment will be sufficient to keep up vitality in the case of a clean incised wound; but if the part is lacerated the retention of vitality in the separated part is not likely to ensue. The constitutional disturbance which a lacerated wound sets up is to be met by simple diet and warm application to the wounded part. The application of warm water to the part affected by means of lint under oil silk is the most comforting. This should be frequently changed, and

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occasionally as inflammation comes on it should be applied cold, to test the comfort. It will be found that sometimes warmth is most soothing, at others the application of cold water is most grateful to the patient, and in all these cases the feelings of the patient may be consulted, and that application used which he finds most soothing and most grateful to his feelings. Some cooling aperient should be given if the bowels are confined and the appetite indifferent; this may consist of a little citrate of magnesia or a teaspoonful of some other aperient saline in warm water. If suppuration arises—that is, if pus or matter forms in the wound—a poultice of bread and water or of linseed meal may be applied with advantage, but these must be made in a proper manner and not in the way in which I occasionally see them done, even in clever people's houses. Skill is required in making a poultice, as well as in every other simple work. The best method of making poultices will be described when discussing the treatment of abscesses. The position of a wounded part should always be such as is most comfortable to the patient. It is a serious error to place it so as to be irksome. Ease should be studied, provided that ease is natural. If it is only found in an unnatural position it is wrong and must be fought against, and in the course of time the unnatural position will be overcome and ease found in a more satisfactory state. When ease is obtained in a position which is unnatural there is mischief going on somehow which must be obviated. Lacerated wounds are sometimes followed by lockjaw or tetanus, as it is surgically called. It is an affection of the spinal cord, which is produced by reflex action proceeding from the nerve which has been lacerated, reacting upon the spinal nervous system. There is a stiffness about the jaws and neck, which is slight at first but slowly increasing in intensity, and ultimately the muscles which move the jaws are no longer able to act; they become fixed and rigid, so that the jaws can neither be opened nor closed, and tetanus is established. It is generally fatal. There is a form of tetanus which arises from other causes, such as poisoning by strychnine, but this latter differs from traumatic tetanus, or that which is due to a wound. In the one case the invasion is sudden, in the other it comes on gradually and of course after a punctured or contused wound has been known to have been received. In lockjaw connected with wounds the mischief is restricted at first to the stiffness in the jaws, but in poisoning by strychnine it almost immediately invades other muscles in the neck and back. It is requisite to keep this distinction in mind, and not let strychnine poisoning be mistaken for lockjaw. Lacerated wounds seldom bleed much, unless an artery has been torn. They are sometimes followed by erysipelas, the course to be followed in such cases will be mentioned when treating of the latter disease.

Punctured Wounds are often more serious even than lacerated wounds, especially when made with a narrow pointed instrument, such as a rusty nail. The thrust of a penknife or one blade of a pair of scissors may go a considerable depth, whilst the external wound may be quite small. In a stab the danger always depends upon the injury which the fibres have suffered from laceration as well as from the cutting surface of the instrument. The puncture may have passed through an artery, or a vein without dividing it, and the surgeons aid must be quickly obtained; in the meantime, it is prudent to keep the wounded part at rest as much as possible and if any application is used let it be carbolised oil poured into the wounded part and the air kept from it, whilst if there is hæmorrhage it may be restrained by gentle pressure upon the wounded part until the surgeon arrives. Suppuration will take place in these cases, and that as well as the constitutional disturbance is to be met as is suggested in the case of a lacerated wound, and we must guard against the violent inflammation which often supervenes.

Poisoned Wounds are of several kinds, such as those produced by the stings of bees, wasps, and hornets, and the bites of vipers and other snakes; the absorption of poison from metallic applications and those which follow upon the absorption of animal poisons, such as comes from the decomposing flesh of animals, and the so-called dissection wounds, which boys will get sometimes from their curiosity in investigating the nature of decomposing animal remains; and, lastly, dog and cat bites, which are very uncomfortable, and frequently most painful. The stings of bees, wasps, hornets, and other insects are best met by applying at once to the injured part some alkali or alkaline earth, which shall neutralise the acid of the sting. The old woman's application of the blue bag is founded upon good chemical action, for the chalk in the blue neutralizes the acid at once, if it be applied immediately. A little sal-volatile in water, one part in three, may be useful if put on immediately, but it is not of any use to apply ammonia in any form, unless at or immediately after the moment at which the bite is inflicted. If any inflammation has come on, the application of sal-volatile or the ammonia salt will increase it, doing harm instead of good, and possibly setting up erysipelas or some other inflammatory action. Every wasp or bee destroys itself by leaving the sting in the flesh of the injured part. This must be extracted by means of a fine pair of tweezers or forceps. The resulting inflammation may be kept down by the application of a cold lotion, or dusting it over with violet powder or simple chalk, and avoiding irritating applications of all kinds, and also keeping it from the effects of the sun-light, if it be a hot day.

Snake Bites in this country are limited to that of the adder. These bites are not usually fatal, unless the blood of the bitten person is in a very unhealthy state from excessive use of stimulants or too much animal food. There is generally faintness immediately after the bite has taken place. This faint condition should be counteracted by some sal-volatile or other diffusible stimulant, and the bitten part treated just as described for a wasp sting. The inflammation and swelling are sometimes very great, and there will be a strong desire on the part of the surgeon to use the knife, and to make free incisions to relieve the tension. I am satisfied from experience that this is wrong treatment, and that every effort should be made to prevent the chance of suppuration, which incision increases. There will be no formation of pus, except under the most exceptional circumstances, and there will be no ultimate danger if suppuration does not arise. Keep the swollen part warm, and avoid pressure. It will be found to subside in a day or two without leaving any mischief behind it. Nitrate of silver is sometimes applied to stay the resulting erythema. This is bad practice.

Wounds which have been poisoned by decomposing animal matter belong to a different category. These are followed by inflammation of the veins and absor-

bents of the part, and quickly extend to the whole of the system. Pyæmia results. In the case of an adder-bite the mischief is restricted to the cellular tissue of the limb affected, and the action of snake-bite is probably chemical. The resulting inflammation does not reproduce its like, but in the dissection wound there is a manufacture of material in the body of a similar kind. The morbid matter is reproduced in quantity, and is capable of reproducing similar mischief in other people. The pain follows the course of the veins and absorbents. There is much constitutional disturbance, and the assistance of the surgeon must be obtained as soon as possible.

(To be continued.)

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Eminent Practical Teachers.

PESTALOZZI.

BY THE REV. CANON WARBURTON, M.A.,
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III.

WE next hear of Pestalozzi at Burgdorf, first in the somewhat unexpected position of assistant to the mistress of the infant department of the 'primary schools' in that town; and a year later, with three partners, in charge of what we should call a 'proprietary school.'

This was in the winter of 1800, and in the following year Pestalozzi published his third celebrated book, entitled 'How Gertrude Teaches her Children.' The title of the book is misleading, for it contains little or nothing specially adapted for the guidance of mothers, and plunges at once into the polemics and the philosophy of education. Nor is the only inconsistency to be found in the title-page. More will be told about this in the next number, in which some account will be given of Pestalozzi's system; but it has been truly said of the volume in question, that 'it contains educational principles of the highest value and importance, side by side with the most glaring blunders and inconsistencies, and has to be constantly corrected by the common sense of the reader.'

But to return to Pestalozzi's work as a schoolmaster at Burgdorf. John Ramsauer, who at the age of ten became one of his pupils there, has given a vivid account of his experiences in the institution, from which the following extracts are taken.

'I got about as much regular schooling as the others, namely, none at all, but our master's sacred zeal, his devoted love which made him entirely unmindful of himself, his depressed and anxious state of mind which even struck us children, made the deepest impression on me, and knit my childlike and grateful heart to him for ever.

'The instruction which we received was limited to drawing, cyphering, and exercises in language. We neither read, nor wrote, nor committed to memory Take as a specimen of an "Exercise in language, drawn from natural history:"—he would say, and we had to repeat the words after him, while our eyes were fixed on our drawing, "amphibious animals—crawling amphibious animals—creeping amphibious animals—monkeys, long-tailed monkeys, short-tailed monkeys," and so on. We did not understand a word of this, for not a word was explained, and it was all spoken in such a sing-song tone and so rapidly and indistinctly that it would have been surprising if any one had understood anything of it: besides, Pestalozzi cried out so dreadfully loud, and so incessantly, that he could not hear us repeat after him; our repetition consisted mainly in saying the last word or syllable of each phrase, thus "monkeys—monkeys, or 'keys, 'keys." There was never any questioning, or any recapitulation.

'As Pestalozzi in his zeal did not tie himself to any particular time, we generally went on till eleven o'clock with whatever he had commenced at eight, and by ten o'clock he was always tired and hoarse. We knew when it was eleven by the noise of other school-children in the street, and then we all ran off without bidding him good-bye.

'The first time that I was taken into Pestalozzi's school he cordially welcomed and kissed me. He then quickly assigned me a place, and the whole morning did not speak another word to me, but kept on reading out sentences without pausing for a moment. As I did not understand a bit of what was going on, when I heard the word "monkey," "monkey," come every time at the end of a sentence, and as Pestalozzi, who was very ugly, ran about the room as if he was wild, without a coat, and without a neckloth, his long shirt-sleeves hanging down over his hands, which swung negligently about, I was seized with real terror, and might soon have believed that he himself was a monkey. During the first few days, too, I was all the more afraid of him, because he had, on my arrival, given me a kiss with his strong prickly beard, the first kiss which I remember having received in my life.'

We may be inclined to smile at this only too graphic picture of the oddities of Pestalozzi, but it is given with perfect simplicity by Ramsauer, whose heart had been completely won by the kindness, and whose respect by the nobility of character of the great teacher. Meanwhile the fame of the institution grew rapidly; numbers of visitors came from all parts of Switzerland to witness the practical working out of the principles enunciated in 'How Gertrude Teaches her Children,' and at the end of three years the school's utility and success were so generally acknowledged that, though conducted as a private adventure, it began to receive small grants from the public funds. But once more Pestalozzi's evil star prevailed; the Directional Government of Switzerland was dissolved by Napoleon and the old constitution of the Cantons restored. The new Bernese administration fixed on Burgdorf Castle for local head-quarters, and the school had to clear out of it on the 22nd of August, 1804. Pestalozzi attended as one of a deputation to Paris elected to represent to 'the First Consul' the 'wants of Helvetia,' but his educational projects altogether failed to attract the interest of Napoleon, who flatly told the discomfitted enthusiast that 'he was not going to mix himself up with the teaching of the A B C.' Another member of the mission was the celebrated educationist Fellenberg, who four years before had founded his well-known school at Hofwyl. When the Bernese authorities turned Pestalozzi out of Burgdorf Castle, they gave up to him the monastery of Buchsee, adjoining which was Fellenberg's estate of Hofwyl, and to him, 'Not indeed without my consent,' says Pestalozzi, 'but to my intense mortification was handed over the general direction of my school.'

Fellenberg possessed in an eminent degree what Pestalozzi so grievously lacked—namely, practical administrative ability. But when, in 1840, this school at Hofwyl was visited by Sir James Kay-Shuttleworth—an honoured name in the history of English Education—Fellenberg admitted that he owed everything to Pestalozzi. In the former the intellect prevailed, in the latter the feelings: under Fellenberg better order was maintained, but love was missing. His hand was found to be too heavy, and Pestalozzi, receiving an urgent invitation from the inhabitants of Yverdun in the Canton of Vaud, migrated thither in 1805 with his school and staff, 'for the teachers,' he tells us, 'found the government of Fellenberg far more distasteful than the want of government under me.'

Pestalozzi was now, at the age of fifty-nine, at the height of his reputation. Yverdun soon came to be recognized as a European training school for teachers. 'Pestalozzian schools' were established at Naples, Madrid, and St. Petersburg. In our own island the well-known educational reformers Bell and Lancaster had adopted many features of his system, and many philosophic writers saw in Pestalozzi and his labours 'the commencement of the renovation of humanity.'

But with all this, the migration to Yverdun marks the commencement of the period of Pestalozzi's greatest unhappiness. 'The institution,' he tells us, 'bore within itself the seeds of its own internal decay in the unequal and contradictory character of the abilities, opinions, inclinations, and claims of its members.' But for the present all seemed bright. One hundred and thirty-seven pupils, of ages varying from six to seventeen, lived in the institution, and twenty-eight lodged in the town, making 165 pupils in all. Among them there were seventy-eight Swiss, the rest were Germans, French, Russians, Italians, Spaniards, and Americans. Fifteen teachers resided in the buildings, nine of whom were Swiss and had been educated under Pestalozzi's eye. A visitor to Yverdun thus describes the externals of the institution:—

'The situation of the old castle, with its four great towers enclosing a courtyard, is extremely beautiful. A vast meadow lies between it and the glorious Lake of Neufchatel, on the west side of which rises the Jura Range covered with vineyards. We met a multitude of boys, who conducted us to Pestalozzi. His dress was the extreme of untidiness. He had on a threadbare old gray overcoat, no waistcoat, and a pair of breeches, and his stockings hanging down over his slippers, his coarse, bushy, black hair unkempt and frightful. His forehead was deeply wrinkled, his dark brown eyes now soft and tender, now full of fire. You hardly noticed that the old man so kindly and genial, was ugly; you read in his singular features long-continued suffering and great hopes.' Its internal condition is thus described by Pestalozzi himself, but it is to be feared—and indeed he subsequently admitted the fact himself—that he saw things through rose-coloured spectacles, and as he would have wished to have them rather than as they were. 'A pure paternal and fraternal feeling everywhere shines forth. The children feel themselves free, and their activity finds a powerful charm in their employments. The life in the house is to a rare extent a school for cultivating domestic affection and domestic unity. The disposition of the great body of our inmates is good: a spirit of strength, of repose, and of endeavour rests on the whole. Some pupils evince an angelic disposition, full of love, and of a presentiment of higher thoughts and of a higher existence. The bad ones do not feel themselves comfortable in the midst of our life and labour; on the other hand, every spark of good and noble feeling which still glimmers even in the bad ones is encouraged and developed. The children are neither hardened by punishment nor made vain and superficial by rewards. Their feelings are not lightly wounded; the weak are not made to compare themselves with the strong, but with themselves. We never ask a pupil if he can do what another can, we only ask him if he can do a thing, but we always ask him if he can do it perfectly. We live altogether united in brotherly love, free and cheerful, and are, in respect of that which we acknowledge as the one thing needful, one heart and one soul.' It may be well to set side by side with this report (in which is to be feared that the indicative is sometimes used instead of the optative mood) some passages from the dispassionate report of the five commissioners sent down by the Swiss Diet at Freiburg to examine the school. 'This institution in no way aims at coming into perfect connection with our establishments for public instruction. Determined at any price to interest all the faculties of children in order to direct their development according to its own principles, it has taken counsel of its own views only, and betrays an irresistible desire to open for itself new paths, even at the cost of never treading in those which usage has now established. This was perhaps the best way for arriving at useful discoveries, but it is also a design which renders harmony impossible. The institution pursues its own way, the public schools pursue theirs, and there is no probability that both ways will soon meet. It is to be regretted that the "force of circumstances" has always driven M. Pestalozzi beyond the career which his pure zeal and fervent charity had marked out for him. Let us profit by the excellent ideas which lie at the foundation of the whole undertaking, but let us also lament that an adverse fate must hang over a man who by "the force of circumstances" is constantly hindered from doing what he would wish to do.'

The publication of this report was followed by a long and embittered paper war, which brought great discredit on the institution by throwing light upon its weakest points. There can be little doubt that the extraordinary prosperity and reputation of the school had turned the heads of the teachers, producing, as Pestalozzi himself admits, 'an audacity of behaviour towards the whole world and towards everything done in education that was not cast in our own mould.' Again, with such a medley of children collected from all parts of Europe, the institution had no mother tongue. Prayers were read every morning first in German and then in French. At the lessons in the German language, intended for German children, there were French children to whom every word spoken was unintelligible. Again, despite Pestalozzi's self-deceiving optimism, the life was as unlike home-life as it well could be, and the little boys especially had to endure much hard treatment and privation. But all these drawbacks sink into insignificance when compared with the bitter dissensions which existed between the subordinate teachers. The two most prominent members of the staff were Schmid and Niederer. Of the former, a Tyrolese shepherd-boy, who had joined him at Burgdorf, 'more rude and unkempt than his master, but with the eyes and beak of a

hawk,' Pestalozzi thus writes, 'By his practical talent and indomitable activity he soared above the influence of every other person in the establishment. I looked upon the *strength* of this pupil, though still so young, as the mainstay of the house,' and later, 'Schmid threw a hard shell round the kernel of my vanishing labours and saved me.' These characteristics made Schmid an invaluable element in an institution conducted by a man 'gifted,' as Pestalozzi says of himself, 'with an unrivalled incapacity to govern,' for Niederer also, the second in command, was completely destitute, as he often acknowledged, of practical ability. He was, however, a youth of high culture and lofty intellectual ambition, and seeing in Pestalozzi, as we are told, 'a man who had grasped with instinctive profundity the subject of human culture, but had given only a fragmentary view of it, and who could not control the ideas which, as it were, possessed him,—he believed that he was himself destined to build up out of those fragments a complete and systematic theory. Both these men, though each in his way more highly gifted than Pestalozzi, loyally acknowledged him as their master, and submitted to his influence in everything except living on friendly terms with each other. Schmid first seceded and wrote against the institution. When he had been prevailed upon to return, thirteen of the staff withdrew, and with them Niederer, whose desertion, and the circumstances which accompanied it, threw the old man into such a passion of grief and anger that he became delirious, and his reason only slowly returned. For he saw in Niederer 'the one man in the institution who, standing on the pinnacle of German culture, was fitted to gain for the new method its proper place in the region of human culture generally.' Only by such a man, he thought, could the educated world be won over to his plans; by such a man only must his Swiss idiom be translated into '*high* German,' nay, for some time he so far argued with Niederer as to think that 'Niederer understood him better than he understood himself.' And now began a money squabble, leading to a protracted lawsuit between Pestalozzi and the seceding teachers, which brought further discredit and pecuniary loss upon the institution, and poisoned all the remaining years of the old man's life. The lawsuit was decided at the end of seven years, and then Pestalozzi determined to transfer his institution from Yverdun to Neuhof, where he had made his first unsuccessful venture just fifty years before. But on his announcing his intention of doing so, the scholars and the remaining teachers refused to accompany him, and nothing was left for him but to close the school. This he did in 1825, and withdrew alone, impoverished, and widowed, at the age of eighty years, to end his days under the roof of his grandson. He had lost his devoted wife about eight years before this last blow. What a chequered life, but with how much more of shadow than of sunshine, must she have led for those five-and-forty years, with a husband capable of such tender attachment, such nobility of feeling, such exalted disinterestedness, but at the same time such an unkempt, thriftless, poverty-stricken, one-idea'd enthusiast as Pestalozzi! When the customary parting hymn had been sung before the closing of her coffin, Pestalozzi turned towards it, and said, 'We were spurned and despised by all; sickness and poverty bowed us down; we ate dry bread with tears. What was it that in those days of trial gave you and me the strength to persevere and not cast our hope away?' Thereupon he took up a Bible, and laid it on the breast of the corpse, and said, 'From this source you and I drew courage, and strength, and peace.'

Pestalozzi's constitution had been weak from childhood. He had undergone severe illnesses, and met with more than one all but fatal accident, yet he lived to drain the cup of a long and disappointed life, and died as heart-sick, and as nearly heart-broken, as it is possible for a brave and religious man to die. His last conscious moments however were lighted up with a parting gleam of his old brightness and serenity. Calling his friends to stand around his bed, he spoke to them thus: 'I forgive my enemies; may they find peace now that I go to everlasting rest. I should like to have lived another month, to have completed my last labours; but I again thank God, who in His providence calls me away. And you, my children, remain in quiet attachment to one another, and seek for happiness in the circle of home.'

He was buried in the little churchyard of Birr on the 19th of February, 1827., Scarcely any persons not of his own family attended his funeral, for the snow lay thick on the ground, and as the interment took place on the second day, the news of his death had reached a very few. But for some time afterwards it was the custom for school children and teachers of the canton of Argovia to come and sing their hymns over his grave.

In the next number some account will be given of Pestalozzi's system.

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Anecdotal Natural History.

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No. XV.—THE MONKEY TRIBE.

Part III.

THE Macaques are all natives of Asia, and include several very well-known monkeys. One of the most familiar of these is the Bonnet Macaque, or Munga (*Macacus Sinicus*), of Bengal and Ceylon.

This monkey derives its popular title from the curious arrangement of the hairs upon the crown of the head, which radiate in such a manner that at a short distance the animal appears to be wearing a kind of cap, or bonnet. The colour of this macaque is an olive-grey.

Like the Entellus, the munga is considered as a sacred animal by the natives of the countries which it inhabits, and is protected accordingly, a place being always prepared in the temples for its habitation. The older and more savage the animal becomes the greater is the veneration in which it is held, no one being allowed to interfere with it in any way, in spite of any depredations which it may commit in the neighbouring villages.

The munga has often been brought to this country, but does not seem at all suited to a life of captivity, its temper being very capricious and revengeful. It does not appear to be nearly as susceptible to kindness as monkeys in general, and never entirely loses its sullen and fierce disposition.

Even in the Zoological Gardens, where the greatest care is taken of the animals, and the keepers are uniformly kind and gentle, the bonnet monkey is apt to be mischievous.

A few days before writing these lines, I noticed that there were seven specimens of the bonnet monkey in the house, and asked the keeper how they behaved themselves. In answer to my question, he showed me his hand, which is disfigured by a large and deep scar on the thumb and wrist.

This scar was the result of an attack made upon him by a large bonnet monkey. He was employed in his usual work in the cage, when, without being provoked or giving notice of its intentions, the animal suddenly flew at him, and before it could be removed, inflicted such terrible bites on his hand and arm, that he had to be taken to a hospital, and remain there for three months.

The well-known Magot, or Barbary Ape (*Macacus Innuus*) belongs to this group, and is remarkable as being the only monkey found in a wild state in any part of Europe. Even these creatures are confined to a single locality, namely, the celebrated Rock of Gibraltar, where they were once found in considerable numbers. Year by year, however, the Rock apes, as they are called, diminish in number, and, before long, will probably be extinct.

It does not appear to be an indigenous inhabitant of that neighbourhood, but would appear to have been imported at some former period from Barbary, where it is very abundant.

There is, however, another theory, namely, that in former times Europe and Africa were united by an isthmus, of which the Rock of Gibraltar formed the European end. The isthmus was by degrees cut away by the sea, and the apes at the European end, being loth to leave their comfortable quarters in the rock, were at last severed from Africa by the waves.

The magot is a very wary and cautious animal, and takes up its abode in the most inaccessible parts of the rock, where its movements can scarcely be observed excepting by the aid of a powerful telescope. Banding together in large flocks, its very numbers render it secure from all enemies, excepting the climbing *felidæ*, which steal upon it during the hours of darkness, and strike down the bewildered animals before they are fairly aware of the presence of their foe.

The magot is regarded with great disfavour by the owners of cultivated lands in the vicinity of its haunts, for it is in the habit of making occasional raids upon the growing crops, conducting these foraging expeditions with so much wariness and caution, that it is very seldom detected by the outraged farmer. Although feeding chiefly upon leaves and fruits of various kinds, it does not by any means confine itself to a vegetable diet, preying largely upon scorpions and insects of various kinds. These it captures by turning over stones, logs, etc., under which many small creatures are in the habit of taking refuge, and snatching them quickly up before they have time to make their escape. The 'Rock apes' have little to feed upon except scorpions, and this may account for their diminution.

It might be thought that the poisonous properties which the scorpion possesses would be quite sufficient to render it secure from the paws of the monkey. Such is not the case, however, the magot invariably twisting off the poison-bearing tail as soon as it seizes its victim, before the captive can find time to inflict a wound upon its pursuer.

While young, the disposition of the magot is docile and gentle, and it can be tamed without any great difficulty. But, as it increases in size, it almost invariably becomes harsh and sullen, just as do the apes under similar circumstances.

The magot is not a very large animal, its average size being about equal to that of an ordinary bull-terrier dog. Notwithstanding the slenderness of limb, the muscular power is wonderfully great, as, indeed, is the case with almost all the animals of the monkey tribe. Even in captivity, where its powers are greatly decreased owing to the narrow space in which it is confined, quite a small monkey may often be seen shaking its whole cage violently to and fro, a feat which would appear remarkable in an animal of double the size.

Nearly all the monkey tribe are fond of mischief, but the magot is perhaps the worst of them all in this respect.

Once I was admiring the graceful attitudes of some magots, when I noticed a lady standing very near the bars of the cage, wearing a new and very conspicuous bonnet, with abundance of flowers, beads, etc., upon it. I pointed out to her a printed warning that the monkeys were mischievous, but as none of them were near, she took no heed of the warning.

Several of the magots were gambolling on some rock-work in the background, while another, the oldest and most mischievous of the monkeys, was sitting apparently asleep on a tree stump in the middle of the cage.

But he was as wide awake as any of us, and was only watching his opportunity. Just as the lady turned round to leave the spot, the monkey sprang from the stump to the cage, and in a moment snatched the bonnet off her head, sprang back to the stump, and there began to investigate his prize.

The bereaved owner shrieked and scolded, but the animal took no heed of her, and with a serious and grave aspect began to resolve the bonnet into its constituent parts. First, he tore off the crown with his teeth, and then pulled out the flowers. Next came the beads, which the monkey hung here and there on the branches. Then he ripped off the veil, and twisted it over his head in mantilla fashion.

This last feat entirely destroyed the gravity of the spectators. Up to that time we had been trying to get the bonnet back, even in its dilapidated condition. But the aspect of that monkey, looking with air of wistful wonder through the veil, was too much for any one to endure, and there was a roar of laughter at the spectacle.

Owing to the very rudimentary nature of the tail, the magot has been considered by many writers to belong to the baboons, while others have ranked it with the apes. It is only of comparatively late years, indeed, that its true position has been satisfactorily determined.

The Pig-tailed Macaque, or Bruh (*Macacus nemestrinus*), a native of Sumatra and the neighbouring islands, is often brought, while yet young, under the dominion of man, and employed in a rather remarkable manner. Being remarkably active, even for a monkey, and possessed, moreover, of a considerable share of intelligence, it is trained to climb the lofty cocoa-nut palms in order to gather the fruit, which it hurls down to its employers beneath. After a short

time, it learns that only the ripe nuts are required, and accordingly selects the matured fruit alone, leaving the remainder to ripen upon the tree.

The last of the Macaques which we can now describe is the curious Wanderoo (*Silenus veter*), a native of the East Indies.

The appearance of this monkey is most remarkable, owing to the heavy mass of long hair upon the head. This hair surrounds the entire face, and falls in a long beard from the chin, giving to the animal the appearance of great age, which is much increased by the grizzled, or even white hue which it often assumes. The extremity of the tail is ornamented by a tuft of black hairs, which has earned for the animal the title of 'Lion-tailed Baboon.'

The wanderoo is regarded with very great respect by the natives, who state that it holds the foremost place among the monkeys of the same land, and that they treat him with the respect due from subjects to their sovereign.

The cheek pouches of the wanderoo are very large, and capable of containing a considerable amount of food. Before beginning a meal, the animal is in the habit of filling these pouches, in order to secure a supply of food in the event of being interrupted before its banquet is completed.

WE now come to the BABOONS, a group of animals whose distinguishing characteristics are very strongly marked. Their chief peculiarity lies in the form of the head, which is aptly described by the scientific title of '*Cynocephali*,' *i.e.*, 'dog-headed,' which has been applied to the group.

A mere glance at the position of the nostrils is sufficient to at once determine whether any monkey belongs to the baboons or not, for in these animals those organs are situated at the extremity of the muzzle, instead of lying flat upon the face, just beneath the eyes, as is the case with all the other members of the monkey tribe. The form of the muzzle, too, is rather remarkable, being abruptly terminated with a round and flattened extremity. All these animals are natives of Africa.

In the baboons, the semi-bipedal character of some of the foregoing monkeys almost entirely vanishes, the animals seldom moving, even for three or four steps, otherwise than upon all fours. They scarcely ever stand upright, indeed, except when upon the look-out for a foe, and even in such a case mostly steady themselves by resting one of the fore-paws upon some convenient object.

While their tactics, when molested, are rather those of defence than offence, the baboons are, nevertheless, very formidable foes, even to man himself, when once fairly brought to bay. Fierce, active, and powerful, their onset is by no means to be despised, and even a single baboon would prove a very terrible antagonist.

Their mode of attack is invariably the same. Leaping at the throat of its enemy, the baboon fixes its long, sharp teeth firmly in the flesh. Then, exerting the full strength of its powerful limbs, it thrusts its foe forcibly to arm's length, tearing its teeth completely through the throat of its victim, and so causing a terrible, and often a deadly wound. In this manner, it is in the habit of repelling the attacks of the hounds employed in its pursuit, galloping on until one of the dogs outstrips its fellows, and suddenly turning and attacking its foe before the latter is able to defend itself. A brief struggle, and the hound lies dying upon the earth, while the baboon rushes on as though nothing of the kind had taken place.

Curiously enough, the hounds do not seem to learn by experience the danger of attacking so formidable a foe, but start eagerly upon the track of a baboon in preference to that of other game.

All the baboons are capital climbers, whether of rocks or trees, from the neighbourhood of which they never stir to any great distance. They are always found in bands, which unite their forces if any danger appears, and, by their mere numbers, bid defiance even to the larger and more savage *carnivora*.

The first, and one of the most remarkable in appearance of the baboons is the Gelada (*Gelada Ruppellii*), of Abyssinia, an animal which has been assigned to a separate genus on account of the peculiarly tufted tail.

The extraordinary aspect of the gelada is chiefly owing to the heavy mass of thick, long hair which covers the neck and shoulders, and which bears an absurd resemblance to the fur tippets so frequently worn by coachmen during cold weather. Upon the young gelada this mass of hair is scarcely visible, the mane, if we may so call it, not attaining its full dimensions until the growth of the animal is complete.

The most widely known of all the baboons is the Chacma (*Cynocephalus porcatus*), of Southern Africa, an animal which is found in great numbers in rocky and broken ground.

The chacma is a terrible foe to agriculturists, making systematic raids, under cover of night, upon the crops in the neighbourhood of its haunts, in spite of any precautions which may be taken by the aggrieved owner with a view to preventing the ravages of his active foes. These raids are always undertaken by a large band of baboons, and are managed in a singularly ingenious manner.

The cunning animals appear to know by instinct that, if the whole number enter the forbidden premises, they must inevitably be detected by the dogs which are keeping watch. So the actual robbery is conducted by two or three of the oldest and most experienced baboons only, who silently climb the fence and make their way to the trees which bear the coveted fruit.

Meanwhile, the remainder of the band form themselves into a long line, reaching from the plantation to their private haunts, a space of a few feet intervening between each animal.

This being done, the chacmas which have been deputed to enter the orchard hand their spoils to the nearest comrade upon the other side of the fence. He hands the booty to No. 3, who in turn passes it to No. 4, and so on until it is safely deposited in the larders of their rocky home. As soon as a sufficient quantity has thus been collected, the baboons leave the orchard as quietly as they entered it, and proceed to revel upon the results of their labours.

When quite young, the chacma is often taken by the natives, and trained to render them a very important service when occasion requires. This consists in the discovery of water in times of drought, for, strange to say, the chacma appears to possess a natural aptitude for finding hidden springs, even when they are concealed at some distance beneath the surface of the ground.

When water shows signs of running short, the

chacma is kept without liquid for twenty-four hours, and its thirst increased by the administration of salt. A long rope is then fastened to its collar, and the animal allowed to take its own course, its master following closely upon its track.

The baboon runs forward a little; then stops, and sniffs the ground; runs forward again; again stops, and so on, every now and then tearing up a blade of grass, or a weed, and carefully smelling it upon all sides. So it goes on, carefully inspecting every likely spot, until, sooner or later, it is almost sure to lead its captors to the wished-for spot. The animal is also employed in searching for roots, etc., which it digs out of the ground by means of its long nails.

The chacma is thought to be a rather long-lived animal, its existence being calculated at about forty years.

Another well-known baboon is the Papion (*Cynocephalus Sphinx*). In former times this animal was regarded with great reverence by the Egyptians, provided with a home in their temples, and its body carefully embalmed and preserved after death. The mummied forms of many of these monkeys have been found in the caves of Egypt, having evidently been prepared with the same care and attention devoted to the corpses of human beings.

The most grotesque, as far as appearance is concerned, of the baboons is the Mandrill (*Papio Maimon*), a native of Guinea.

The body of this baboon is ornamented with almost every colour of the rainbow, arranged chiefly upon those parts of the body where such decoration would least be expected. Thus a patch of brightest blue adorns either side of the nose, which is swollen into two large projecting masses just beneath the eyes. These prominences are deeply grooved, and are variegated with lines of scarlet and purple alternating with the blue. The extremity of the muzzle is of a brilliant crimson.

The hinder quarters are also liberally decorated with rich carmine and purple, the mass of colour giving a very strange appearance to the animal. This is greatly increased by the projecting cheek-bones, which are even more protuberant than is the case with monkeys in general, and impart an expression of great brutality to the face.

Nor does the countenance belie the disposition of the animal, for of all the monkey tribe scarcely any is of so sullen and ferocious a nature as is the mandrill. It is liable to sudden and uncalled-for fits of passion, in which the animal seems literally carried away by its own fury. More than one instance has been known where the wild rage exhibited by the mandrill has been too much for the powers of the mind, the animal falling dead from the very violence of its own passions.

Naturally, such an animal is scarcely fitted for a life of captivity, the specimens which have been taken alive proving, except in a few isolated instances, utterly savage and untameable. There are few creatures, indeed, which seem so little amenable to kindness, care and attention appearing to be utterly thrown away upon this animal.

The mandrill is one of the largest of the baboons, an adult male measuring, when fully erect, nearly five feet from the crown of the head to the sole of the foot. In this country, however, the animal seems never to attain to its full dimensions, in common with almost all the members of the monkey tribe, seldom exceeding an ordinary terrier dog in size.

Its strength is wonderfully great, even for a monkey, and an angry mandrill would be far more than a match for an unarmed man. The natives dread it so greatly that they will not even enter the woods where it resides, except in large and well-armed bands.

The food of the mandrill, in common with the other baboons, is chiefly of a vegetable nature, varied with centipedes, scorpions, insects, and other small creatures. It is sometimes, however, known to attack larger game, and to prey upon birds, reptiles, and the smaller quadrupeds. Like the wanderoo, it usually fills its cheek-pouches before commencing its banquet, in order to make certain of a second meal if the first should happen to be interrupted.

The fur of the mandrill is of an olive-brown hue, becoming grey upon the under side of the limbs. Upon the chin is a pointed yellow beard. The gorgeous colours with which the face and the hind-quarters are adorned are seen in their full perfection only in the adult male, the female having the blue patches upon the muzzle alone, and even those being of a paler hue than in her mate. These brilliant hues appear to be dependent upon the health of the animal, becoming dimmed if their possessor be at all out of condition. After death they entirely fade away, the skin becoming of an uniform black colour.

The Drill (*Papio Leucophæus*) is also a native of Guinea, and is frequently confounded with the mandrill, from the young of which animal it can with difficulty be distinguished. Consequently, we know very little of its habits when in a wild state, few travellers having discriminated between the two species with sufficient exactness to furnish us with a trustworthy account of its mode of life.

This baboon is devoid of the brilliant patches of colour which adorn the last-described baboon, the protuberances upon the face being also very much less strongly marked. In other respects it is not at all unlike the mandrill, and we can scarcely wonder that the two animals have so often been confounded with one another.

All the foregoing animals appear to possess a very good notion of the power of combination as a means of defence against their enemies. There are few animals which will dare openly to attack a flock of baboons, even the lion itself considering, in this instance, discretion to be the better part of valour, and prowling round the outskirts of the band in the hope of snatching up some straggler.

When upon the march, they travel in an almost military manner, the young males being placed in the van, and deputed to survey the ground over which the band is to travel, the females and young in the centre, while the older and more experienced males bring up the rear.

We must now bid farewell to the baboons, to proceed to the curious groups of monkeys which are found in the American Continent.

(To be continued.)

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'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

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FOURTH-SCHEDULE SUBJECTS: MECHANICS.

THE following is an outline of a lesson given to boys in Standards V. and VI., on 'Attraction of Gravitation,' 'Gravity,' and 'Weight.'

In our lesson upon 'Energy' one of you boys, I think it was Howell, made a remark about the water flowing down the mountain. Do you remember what you said was the cause of the water coming down? Ans.—I said that the man knocked away the wall that kept the water up, and so it all rushed down. Ah, yes; but I think you gave some reason for the water coming down after the wall *was* broken down. Ans.—No, sir; I don't remember. (A boy, Smith)—It was I, sir, who said it was the attraction of gravitation that made the water come down. So it was, Smith. Well, I want to have that point cleared up this morning. (A boy putting up his hand.) Well? Please, sir, if the man hadn't broken down the wall the attraction of gravitation wouldn't have made the water come down. (Another boy)—But if the man *had* knocked away the wall, and there had been no attraction of gravitation, the water wouldn't have come down. (A boy, Jones)—What *is* the attraction of gravitation? Ah, that is what I want to make clear. We have often spoken about the attraction of gravitation: now what *is* it, think you? Ans.—The power the earth has of drawing everything to it. Is it only the earth that has this power you speak of? No, sir; other things have; the moon has. Indeed? Ans.—Yes, sir: Mr. Allen said the moon attracted the water of the earth, and so caused the tides. (A boy)—No; Mr. Allen didn't say that. He said it was just as true to say the water attracted the moon as to say the moon attracted the water. (Another boy)—It says in our books that *all* the earth attracts the moon. And does it? Ans.—Yes, sir: if it did not, the moon would fly away from the earth. (A boy)—Where would it fly to? (Previous boy)—To the sun. Why do you think it would fly to the sun, Smith? Ans.—Because the sun is so much bigger, and would attract it; and if the sun didn't attract the earth, that would fly away too. Now stop a minute, boys, and see where we are getting to. One boy says the water comes down the mountain because the wall is broken down; another boy says it is because the earth draws it down; another, that the earth attracts the moon; another, that the moon attracts the earth; and yet another, that the sun attracts the earth. Now what do you mean by 'attract'? Ans.—'To draw to,' or 'to pull.' Very good. Here is a piece of chalk in my hand. I let go my hold upon it. You see it falls. You think you know a cause for that falling, do you not? Ans.—Yes, sir; we do know. Do you? What is it? Ans.—The earth draws it. Indeed, does it? Come here, Cox. Now you see I have taken this boy by the hand, and am pulling him after me all over the room. Why did Cox follow me about in this way? Ans.—Because you pulled him—you forced him to go. Yes, I exerted a force: what was the name of that force? Ans.—Muscular force. Now do you mean to tell me that the earth was pulling at that piece of chalk somewhat in the same way that I was pulling at Cox? Ans.—Not in the same way, because the earth has no muscular force. Just so; but has it any other force to pull? No answer? Ah, you don't know whether it has; nor do I; nor does anybody else. (A boy)—The earth draws because of its attraction. Indeed? You just said 'attract' means 'to draw;' so now you say the earth attracts because it attracts. What sort of reason do you call that? Ans.—A rather stupid one. Yes, I should think so. All we know about the chalk is this: it falls to the earth when there is nothing to keep it up; and when there *is* something to keep it up it still tries or tends to fall. Whether the earth is drawing it or not we do not know. And so the water on the earth, and the earth itself, tend to fall to the moon, and the moon tends to fall to the earth, and the earth tends to fall to the sun; and what can we say about everything on the earth? Ans.—Everything tends to fall to the earth. We have a word which is the name of this general tendency. I will write it on the board: 'Gravity.' Now what do we understand by gravity, so far as our earth is concerned? Ans.—The tendency of everything to fall down. Fall down? Ans.—Yes. Ah, we must be careful about saying 'fall down.' Suppose a chimney-pot fell off this school, where would it fall? Ans.—Down to the ground. Well, and suppose a chimney-pot fell off a school in New Zealand, where would it fall? Ans.—Down to the ground there. Just so; but would the two fallings be in the same direction? Ans.—No, sir: quite opposite. Very well; so that 'down' in New Zealand would be 'up' here in England. Hence we had better not say 'down:' we will only say 'to the earth.' Now I will again ask the question we started with. Why does the water run down the mountain? Ans.—Because it has a tendency to fall. Just so; *that* is all we can say about it; and what is the name of this tendency? Ans.—Gravity. (A boy)—Please, sir, can't you say the earth has a tendency to draw the water to it? That is a very fair question, Smith: you would rather say the earth has a tendency to draw the water than that the water has a tendency to fall to the earth. (Smith)—Yes, sir; and I would call this tendency the attraction of gravitation. Very well. Now let us talk a little about what Smith says. Some time ago a man went to a mountain near Edinburgh and hung up a large weight by a long string. He then found that the string did not hang quite straight: it inclined a little towards the mountain. (Smith)—Yes; that was because the mountain attracted the weight. (Another boy)—No; it was because the weight had a tendency to fall to the mountain. (Another boy)—Please, sir, that's all the same thing. Stop a minute, boys: I don't think that *is* all the same thing. Do we see that every single thing has a tendency to fall to the earth? Ans.—Yes, sir; everything. Very well; then we can be quite certain about that tendency. Now do we see that the earth draws everything? Ans.—No, sir. (Smith)—But we can suppose it does. Ah, now we are coming to the point. Your 'attraction of gravitation,' Smith, is only a supposition. We really know nothing about it. But what of 'gravity'? Ans.—We are certain of it. Yes; it is a fact that everything has a tendency to fall. Now we will get on. Has everything the *same* tendency to fall? For instance, here is a lump of lead; here is a piece of wood. I let go. Do they both fall with the same

force? Ans.—No, sir: the lead falls heaviest. What do you mean by 'falling heaviest'? Ans.—Strikes the ground the hardest. Very well. Here is a small piece of wood; here is a large piece. They fall. Which falls the heavier? Ans.—The large piece. Yes; we could say the lead has a greater tendency to fall than the wood, and the large piece of wood a greater tendency than the small piece. Now I should like to measure this tendency; to say, for instance, what amount of tendency to fall there is in the lead or in the wood. Is there any way of doing this? No answer? Well, look. This piece of wood weighs six pounds, and this piece one pound. You said this large piece of wood has a greater tendency to fall than the small piece. How much greater? Ans.—Six times as great. Why do you say so? Ans.—Because it weighs six times as much. Then you think the weight of a thing is the measure of its falling tendency? Ans.—Yes, sir. Then shall we say 'weight is a measure of gravity'? Ans.—Yes, sir. (A boy, Howell)—No, sir. Ah, Howell says 'No.' Why not, my boy? (Same boy)—Because I have got down in my exercise-book that weight is a measure of the amount of matter there is in anything, or a measure of mass. Here it is, sir (showing the book). It was in your lesson upon matter. (Another boy)—Yes, sir; I have written that too. Just so. Now the question is, What *is* weight? (Smith)—We know what weight is. Do you? (Same boy)—Yes, sir; it is the amount of gravitation acting upon a body. I have read that in a book. But, Smith, we have decided that your attraction of gravitation is only a supposition. Are you going to measure a supposition? (Same boy)—Then weight is a measure of gravity. Very well, Smith; but Howell says it is not. We will inquire. What do you mean by saying this piece of wood weighs six pounds? Ans.—We mean that there are six pounds of matter in it. (A boy)—Couldn't you say the gravity of it was six pounds? (Another boy)—That would be very silly. How could you have six pounds of 'tendency'? You *can* have six pounds of matter. (Howell)—Please, sir, the tendency to fall depends upon how much matter there is in anything. Ah, now, boys, we are getting near the truth. What word have I given you for 'quantity of matter'? Ans.—Mass. And for tendency to fall? Ans.—Gravity. What does gravity depend upon? Ans.—Mass. Just so. The greater the mass—(ans.) the greater the gravity. The less the mass—(ans.) the less the gravity. And what is the measure of mass? Ans.—Weight. Yes, and we will keep it so. Now tell me why the gravity of this large piece of wood is greater than that of the small piece. Ans.—Because it is a greater mass. Why is the gravity six times as great? Ans.—Because there is six times as much mass. How do you know that? Ans.—Because it weighs six pounds, and the other weighs only one pound. Very good. Now, my boys, we have been using these words hitherto with no very definite meaning. We can't settle everything in one lesson, you know: we must travel step by step. But after to-day, whenever we use those terms, we will mean exactly what I am now going to tell you to write in your exercise-books, which you may now take out. Gravity is the tendency of every mass of matter to fall towards every other mass. Attraction of gravitation is a name given to a supposed cause of this tendency. Weight is a measure of mass.

This concludes all I have to say upon the second stage, Mechanics. Next month I will give a detailed syllabus of the third stage.

'How I Teach Arithmetic.'

(*Continued from page 76, vol. II.*)

BY WILLIAM SPENCER,
Author of 'Spencer's Exercises in Arithmetic.'

As the above five sub-divisions (*d*) contain, at least in principle, every conceivable form in which a question can be presented, boys should be encouraged to look at the principle on which any such question is based, rather than to work by any formal rule, which is far more likely to be applied wrongly than rightly. As I have before remarked, the working here presumes a thorough knowledge of fractions, supposed to have been obtained before commencing percentages. Scores of questions, coming promiscuously under any of these subdivisions, should now be given, alternating with those previously given, under any other branch of percentages,—interest, discount, etc. We will close our remarks on profit and loss by working out a somewhat difficult question taken from my exercises in 'Percentages' (No. 160):—A corn dealer had 550 quarters of wheat, for which he was offered £2 11s. 6d. a quarter; he kept it 6 months, and then sold it at £2 13s. 9d. a quarter. What did he gain or lose by keeping it, reckoning money at 5 per cent. per annum, the wheat having lost ½ per cent. by measure, the charge for warehousing, etc., being 7¾d. per quarter on the original quantity. First, £2 11s. 6d. = £2·575, which × 550 = £1416·25 what the wheat could have been sold for (say on January 1st) six months before it *was* sold. Second, 550 quarters less ½ per cent., that is $\frac{1}{200}$ of itself, = 550 − 2·75 = 547·25 quarters actually sold (say on July 1st), and (£2 13s. 9d. =) £2·6875 × 547·25 = £1470·734375 amount actually sold for. Third, had it been sold on January 1st, the amount received, 1416·25 would have been at interest for the six months ending July 1st, making £1416·25 ÷ 40 (5 per cent. for a year being $\frac{1}{20}$, hence, for half a year, $\frac{1}{40}$) = £35·40625; hence, had the wheat been sold on January 1st, the amount received on account of it on July 1st would have been £1416·25 + £35·40625 = £1451·65625. Fourth, £1470·734375 − £1451·65625 = £19·078125 = £19 1s. 6¾d.; from this (fifthly) must be deducted the cost of warehousing, etc., which equals 7¾d. × 550 = 4262½d. = £17 15s. 2½d. Hence, £19 1s. 6¾d. − £17 15s. 2½d. = £1 6s. 4¼d. *gain* by keeping the wheat. Ans. As each step of the above seems tolerably plain and followable, we make no further remarks on it.

(*e*) *Commission, Brokerage, Insurance, etc.*, comprise the simplest form of percentages, requiring very little thought and being easily worked. The terms should be first defined, *Commission* being an allowance per cent. for receiving, collecting, paying, etc., of any sum of money. *Brokerage* might be defined as an allowance per cent. for buying and selling goods, etc. The two terms, however, are gradually becoming synonymous and interchangeable. *Insurance* tacitly reveals its own meaning to an adult, but the nature of insurance—fire, life, etc.—might be cursorily touched upon to a class of boys. Examples:—

e.g. (1st) Find the commission on £3752 12s. 6d.

at $1\frac{1}{2}$ per cent. £3752 12s. 6d. = £3752·625 = 37·52625 *hundreds* of £'s, then $1\frac{1}{2} \times 37{\cdot}52625 =$ £56·289375 = £56 5s. $9\frac{3}{10}$d. Ans.

e.g. (2nd) What is the brokerage on £4363 5s. at 4s. 6d. per cent.? £4363 5s. = 43·6325 hundreds of £'s, then 43·6325 × $4\frac{1}{2}$ = 196·34625s. = £9 16s. $4\frac{31}{200}$d.

e.g. (3rd) Find the premium for insuring a building worth £7847 10s. at 5s. per cent. As 5s. is $\frac{1}{4}$ of a £, it is $\frac{1}{400}$ of a hundred £; hence the amount of premium will be £7847 10s. ÷ 400 = £19 12s. $4\frac{1}{2}$d. Ans. The word 'premium' as used in insurance business should be explained.

e.g. (4th) The amount paid for insuring a warehouse at 3s. 9d. per cent. is £11 18s. $1\frac{1}{2}$d., find for what sum it is insured. The building must be insured for as many £100's as there are 3s. 9d.'s in £11 18s. $1\frac{1}{2}$d. Bringing both to three-halfpences we have 1905 ÷ 30 = $63\frac{1}{2}$ hundred £'s = £6350. Ans.

e.g. (5th) A machine being sold for £124 10s., an agent received as his brokerage £9 6s. 9d.; what was the rate per cent.? As £100 is $\frac{200}{249}$ of £124 10s., and as £9 6s. 9d. = £$9\frac{27}{80}$ = £$\frac{747}{80}$, then $\frac{200}{249}$ of £$\frac{747}{80}$ = £$7\frac{1}{2}$. Ans.

e.g. (6th) For what amount must a ship worth £9800 be insured at 2 per cent., so that if she be wrecked the value of the ship and the premium may both be recovered? (*Spencer's* Percentages, No. 113). Questions of this nature I generally find a sore puzzle to examinees; the principle upon which it is based may be explained, however, by showing that every £100 insured must include the rate per cent. of insurance:—thus, if the rate be 1 per cent. then every £99 of value in the ship must be insured for £100, if the rate be 5 per cent. then every £95 for £100, and in the given question as the rate is 2 per cent. then every £98 must be insured for £100. Then £9800 ÷ 98 = 100, the number of £'s 98 in the value of the ship, and as each of these hundreds must be insured for £100, hence £100 × 100 = £10,000 Ans. Here explain clearly that the amount paid for insurance would be £2 × 100 = £200, which, with the value of the ship (£9800 + £200) = £10,000. The above will, it is hoped, suffice for this branch of percentages.

One of the most important, if not *the* most important, branches of percentages is *(f) Stocks, Shares, Debentures*, etc., my mode of teaching which I will now explain. First as to Stock, or as it is more commonly used in the plural form—Stocks. By this term we generally understand money borrowed by some nation, in sums of £100, for which the nation through its representatives promises to pay a *fixed* rate of interest, irrespective of any rise or fall in the value of money. The length of time for which the money is borrowed is sometimes for a definite number of years, but far more generally without any period being specified,—in fact in perpetuity. But although the money thus invested cannot be withdrawn at the will of the investor, he can sell or transfer the right to receive the fixed interest to a third party. This transfer is daily going on, so stocks and shares are constantly changing owners, the same as any other kind of property.

I should illustrate as follows:—Suppose our own or some other national government finds it inconvenient to raise as much revenue in any (say) year as will meet its expenditure, as in time of war or other emergency, it has recourse to borrowing. Suppose ten millions sterling were borrowed at 4 per cent., and that I lend £100 towards it. I receive a document stating that the nation owes me £100, for which it will pay me £4 a year, or more frequently £2 each half year. After a while I want my money for some other purpose, and supposing money to be of the same value, that is, will bring in the same rate of interest, I can most probably through some stockbroker sell out my £100 stock for £100, I giving up the document I received to the buyer, and with it of course the right to receive the interest. The buyer would now for a small fee, be registered on the government books as the owner of what was previously my £100 stock. Suppose, however, that the value of money has risen to 5 per cent. when I wish to sell out, then nobody would give me £100 for the right of receiving £4 interest; but I might sell it for £80, as if £80 makes £4 interest, it is at the rate of 5 per cent. On the other hand, should money be cheaper, that is at a lower rate of interest, I might be able to sell for more than £100. If money were only making 3 per cent. interest I could get £$133\frac{1}{3}$ for it, as it would require £$133\frac{1}{3}$ at 3 per cent. to make £4 interest. Here I have supposed that the *security, continuance of payment*, etc., remained the same, since the rise and fall in the price of stocks will depend on these contingencies as well as on the rate of interest obtained. The price will be affected also as to the amount of interest that has accrued at the time of transfer, whether just after the interest has been paid (when such fact is expressed in share lists by *x. d.*—ex dividend), or when more or less interest has accumulated. Of course the price will be lower *x. d.*, and higher when the dividend is nearly due.

We will now work out a number of questions embodying the various principles and operations that can ordinarily occur. (1) *e.g.* What annual income should I get by laying out £3564 in the purchase of 3 per cent. stock at 81? Here explain that £100 nominal stock can be bought for £81, showing that money is dearer now than when £100 only made £3 interest, that is, that £81 would now make £3 interest. At the commencement this requires to be clearly impressed on the minds of the scholars, otherwise they fail to see the difference between the real and nominal value of the stock. Line upon line is here required, as a boy seems to think that a £100 (nominal) must always be worth £100 (real). We see the same lack of perception even in adults often, as who has not heard the remark concerning some individual who has stock or shares in a concern that is going to the bad, 'he should take his money (in full of course) out of it'? Of course 'he' should not lose anything whoever else did. To return from this digression, as £81 invested makes £3 interest, then as many times as £81 is contained in £3564 will give the number of £'s 3 interest;—hence 3564 ÷ 81 = 44, the number of £'s 100 worth of stock bought, and as each £100 (nominal—really cost £81) makes £3 interest,—£3 × 44 = £132. Ans. Having finished the working of this *first* question, I would ask every conceivable question respecting it:—How much money is invested? What principal invested makes £3 interest? Here some will say £100; again explain that £81 invested makes £3. As an alternate method of working the question show that as £81 makes £3, then £81 ÷ 3 = £27, the principal required to make £1 interest; hence £3564 ÷ 27 = £132. Ans.

(2) *e.g.* What sum must be invested in the 3 per cents. at 94¼, to yield an income of £750 a year? Here first elicit that £94¼ makes £3 interest; but we require a principal to make £750 interest, hence £750 ÷ £3 = 250, the number of £'s 94¼ required; then £94·25 × 250 = £23,562 10s. Ans. The above appears so simple as to require no further explanation.

(3) *e.g.* How much stock at 92½ can be bought for £23,712, a commission of ⅛ per cent. being charged on the stock purchased? £92½ + £⅛ = £92⅝ cost to the buyer of £100 stock. Here explain again that the stock is below its nominal value—£100, which is called *par*. Show plainly that when the nominal value and cash value are alike, stocks are said to be at *par*. Here £100 worth of stock can be bought for £92⅝, hence the number of times that £92⅝ will go in £23,712 will give the number of *hundred* pounds of stock bought; then (£23,712 ÷ £92⅝) = (189,696 ÷ 741) = 256 hundred, and 256 × 100 = £25,600. Ans. Here call attention to the fact that more stock can be bought than the money invested, £25,600 worth for £23,712, as the price was below par, £92⅝ for £100 worth. Explain again that at some previous period this £100 has most probably cost somebody £100, but the price has now fallen to 92⅜. I say most probably, because either now or afterwards, I should explain that stocks are often *first* issued below par, say £91½ for £100; and sometimes even above par, say £102½ for £100.

(4) *e.g.* If I lay out £1,000 in the 3½ per cents. at 96, what should I lose by selling out at 95? (*Colenso*, Stocks, No. 9.) Here, as no interest or dividend is to be reckoned, the '3½ per cents.' is just a little 'dust' to be brushed away, being no use, but rather a hindrance to working the sum. As £100 stock can be bought for £96, then £1,000 ÷ £96 = 10⅝ the number of cents. of stock bought. As the buying price is £96, and the selling price £95, then £1 must be lost on every £100 worth of stock bought. Now, 10⅝ hundreds of stock were bought, then the loss is £10⅝ = £10 8s. 4d. loss. Ans.

(5) *e.g.* A person transfers £11,000 from the 4 per cents. at 92 to the 5 per cents. at 110; what is the difference in his income? (*Colenso*, Stocks, No. 12.) He has £11,000, that is 110 *hundreds* of 4 per cent. stock, hence it is making him £4 × 110 = £440 a year. He now sells out at 92, hence £92 × 110 = £10,120, the cash received for £11,000 worth of 4 per cent. stock. Then £10,120 ÷ £110 = 92 *hundreds* of 5 per cents. bought. Then £5 × 92 = £460 interest derived from the new investment, hence £460 − £440 = £20 gain. Ans. Now question closely the steps gone over in working this question. First, the interest the money made in the 4 per cents., £440 a year; second, the amount received on selling out, £10,120; third, how much 5 per cent. stock bought, 92 cents.; fourth, the interest this makes, £460; fifth, the gain per year, £460 − £440 = £20. Ans.

(6) *e.g.* A person invests £18,150 in the 3 per cents. at 90¾, and, on their rising to 91, transfers it to the 3½ per cents. at 97½; what increase does he make thereby in his annual income. (*Colenso*, Stocks, No. 14.) First cause the class to notice carefully the difference of expression between the beginning of the two questions. In the last question the person *held* the stock and then transferred it; here we have a preliminary step the first stock being to *purchase*, and then afterwards to transfer. Show thoroughly the difference between these two expressions before proceeding to work the question. £18,150 ÷ 90¾ = 200 cents. of stock bought; then £3 × 200 = £600 yearly interest from the 3 per cents. £91 × 200 = £18,200 amount obtained on selling out, which is £50 more than was invested. Show that this is easily seen at a glance to be correct, as he gains (91 − 90¾ =) £¼ on each cent. of stock bought; and as 200 cents. were bought, £¼ × 200 = £50, the gain on selling out. Again, £18,200 ÷ 97½ = 186⅔ cents. of 3½ per cent. stock bought; hence (£3½ × 186⅔) = (½ × $\frac{560}{3}$ = $\frac{3920}{6}$ = £653⅓ = £653 6s. 8d.; and £653 6s. 8d. − £600 = £53 6s. 8d. gain. Ans. Again call attention to the fact that this question is precisely similar to the last, except the preliminary step as previously pointed out, there being six steps instead of five, which again carefully enumerate.

(7) *e.g.* By selling out from the New Zealand 5 per cents. at 103½, and investing in the Queensland 6 per cents. at 112½, an increase of £4 17s. 6d. income was obtained. What was the amount of stock sold out? (*Mansford*, Misc. No. 17.) We will first find what interest £100 N.Z. stock sold out will produce when invested in Queensland stock. It sells for £103½, and as 112½ will make £6 a year, the interest obtained will be $\frac{103\frac{1}{2}}{112\frac{1}{2}}$ = $\frac{207}{225}$ of £6 = £5⅓. That is, as the N. Z. stock was only 5 per cent., £⅓ additional yearly interest will be made on every £100 sold out. But the total gain in interest is £4 17s. 6d., or £4⅞, hence (£4⅞ ÷ ⅓) = ($\frac{39}{8}$ × $\frac{3}{13}$) = 9⅜ hundreds, which being multiplied by 100 will give £937 10s., the amount of N.Z. stock sold out. Ans. Here point out again that, as we are to find the amount of stock sold out, we must naturally find first what *any* given amount would make when transferred, the simplest amount, of course, being £100. Impress well that this £100 before transfer made £5, but that it now makes over £5½. Thorough oral explanation will always pay well in results.

(8) *e.g.* A sum is laid out in the 3 per cents. at 89⅜, and a half year's dividend received upon it; the stock being then sold at 94⅛, and the whole increase of capital being £54, find the original sum laid out. (*Colenso*, Stocks, No. 19.) This question, in its general features, is somewhat similar to the last, with, however, some points of difference. As in it, we will make £100 stock bought the base of operation, the cost of which is £89⅜. The *half* year's interest will be £1½, pointing out here clearly again that it is reckoned on the £100, not on the price given for it, the interest being a fixed rate on the nominal or original issue, irrespective at what price the stock changes owners. Then 94⅛ + 1½ = £96⅛, the full amount, including interest and selling price, obtained for every £89⅜ invested; hence £96⅛ − £89⅜ = £6¾, the profit got on every £100 worth of stock bought. Then £54 ÷ £6¾ = 8, the number of *hundreds* bought, and as £100 stock cost £89⅜, then £89⅜ × 8 = £715. Ans. Here mark well the distinction between the money actually invested, £715, and the stock bought, £800.

(9) *e.g.* The sum of £1001 was laid out in the 3 per cents. at £89⅜, and a whole year's dividend having been received upon it, it was sold out, the whole increase of capital being 72 guineas; find at what price it was sold out. (*Colenso*, Stocks, No. 20.) First step—£1001 ÷ 89⅜ = 11⅛ cents. of stock bought;

second—£3 × 11½ = £33 12s., the year's dividend; third—72 guineas = £75 12s., the *whole* increase of capital, and as £33 12s. of this consists of the year's dividend, then £75 12s. − £33 12s. = £42, the gain on selling out—that is, on selling 11½ cents. of stock; hence, fourth step—£42 + £1001 = £1043, the cash received for sale of 11½ cents. of stock; then, fifth—£1043 ÷ 11½ = 93⅛. Ans.

(10) *e.g.* What ought to be the price of £100 of bank stock which pays a dividend of 10¼ per cent., in order that it may pay 4 per cent. on the money invested? (*Spencer's* Government Questions, No. 130.) As £100 is required to make £4 interest, the principal required to make £10¼ interest must be (10¼ ÷ 4 =) 2 9/16 of £100 = £256¼. Ans.

(11) *e.g.* Bank stock paid 5¾ per cent. A person, after the deduction of 4d. in the £ on her dividend, received £25 16s. 3d. How much Bank stock did she hold? (*S.* G. Q., No. 219.) She paid 4d. in the £, that is, 1/60 of her gross dividend, in tax; hence, £25 16s. 3d. is 59/60 of the gross dividend; then (£25 16s. 3d. ÷ 59) × 60 = £26 5s., the full dividend. As £100 makes £5¼, then £26 5s. ÷ £5 5s. = 5 *hundreds* of stock held, that is, £500. Ans. Each step of the above seems so natural as to require little further iteration.

(12) *e.g.* A railway paid 4½ per cent. on capital, when its weekly receipts were £23 per mile, and 3½ per cent. on capital when its weekly receipts were £20 per mile. How much capital per mile was involved, supposing the working expenses per mile to be the same in both cases? (*S.* G. Q., No. 218.) This question, though somewhat formidable to look at, can be worked mentally in a few seconds. Thus, as £3 deduction in recepts per *week*, that is, £156 a *year*, makes a difference of one per cent. in the dividend, then £156 must be 1/100 of the capital involved in each mile, hence £156 × 100 = £15,600. Ans.

As one or other of the above twelve questions involves every phase under which *stocks*—that is, where the capital, of whatever kind, is held in nominal sums of £100—generally present themselves, we will now peruse *shares*, etc., held in other nominal amounts. Having the first division of my first class, consisting of about thirty scholars, before me, I should proceed to make some general remarks respecting the mode in which great undertakings, requiring considerable capital, are carricd out. I should instance railways, canals, docks, banks, large manufacturing or shipping companies, etc., and should remark that in some countries these are undertaken and carried on by the Government, but that in the British Isles these are left to private enterprise. As the amount of capital required is generally more than one person has at command, a number of persons join in finding the money, and share *pro rata* in the profits—or losses. These combinations are called joint-stock companies, and trade under some specific name or title. I here explain ordinary shares, preference shares, debentures, etc., each company being authorized by Parliament to raise a certain amount of capital as above, and no more. We will work out a few questions, and comment freely where necessary.

1st Example. The share capital of a dock consists of 50,000 ordinary shares of £40 each, 25,000 preference shares of £40, having a prior claim of 4½ per cent., and half a million sterling in 4 per cent. debentures;—the yearly net profit amounts to £185,000. Find the dividend on each ordinary share, and the rate per cent. The debentures have the first claim, and must be paid half-yearly, or yearly, or the liability continues as a debt—if unable to pay in any given period—claimable on future earnings. The interest required on these debentures is £500,000 ÷ 25 = £20,000. Preference shares have generally only a claim for any specific year, the liability not being carried forward to future years as in the case of debentures. Sometimes, however, this claim does extend to future earnings, all depending on the explicit terms on which the capital was raised. The interest required for these preference shares is £40 × 25,000 = £1,000,000 the preference capital, which at 4½ per cent. = £45,000. Then the amount of dividend to distribute among the ordinary shareholders is £185,000 − (£20,000 + £45,000) = £120,000. As there are 50,000 of these shares, then £120,000 ÷ 50,000 = £2 8s. per share dividend. Ans. Hence, as £40 makes £2 8s. dividend, £100 makes 2½ times £2 8s. = £6 per cent. Ans. I should now go over the work as exhibited on the board, twice or three times, and question exhaustively on the operations performed.

2nd Example. Which is the more profitable investment—to buy £100 railway shares at 125, or £6 bank shares at 9⅜, the railway paying 6¾ per cent. dividend, and the bank 7½ per cent? (*S.* G. Q., No. 57.) Of course the dividends per cent. given are on the nominal value of the shares, if not so there would be nothing to find, as 6¾ and 7½ would be the answers. I make this remark, because one examinee, at least, when the question was given at Christmas 1875, "could see nothing to answer." In the case of the railway shares, as £125 makes £6¾ interest, then £100 makes 100/125 or ⅘ of 6¾ = ⅘ of 27/4 = 5⅖ per cent. Ans. Again, the £6 bank shares pay 7½ per cent. on their nominal value (£6), but as they cost £9⅜ they will only pay $\frac{6}{9\frac{3}{8}} = \frac{48}{75} = (\frac{16}{25}$ of $7\frac{1}{2}) = (\frac{16}{25}$ of $\frac{15}{2}) =$ ($\frac{8}{5}$ of $\frac{3}{1}$) = 2⅘ = 4⅘ per cent. Ans. Hence, the railway shares pay £⅗ or 12s. per cent. better than the bank shares.

3rd Example. A person invests £6750 in the Diddlem Gold Mining Co. Limited, in £15 shares, which the first year pays 12½ per cent., and the second year 2s. 6d. a share. He then sells out at £2 10s., and invests the *entire* proceeds in Northport Pier preference £10 shares at £14⅓, paying 7½ per cent. on the original issue,—find his yearly interest after transfer. I should here first explain the meaning of the term 'limited' as applied to companies—no liability can come on the shareholders beyond the full amount of each share taken up. Hence, the word 'limited' must be part of the title of the company, always appearing in whatever manner the name is exhibited, so that creditors must judge for themselves as to trusting the firm. There appears, however, in this company to be one qualification *un*limited, as in scores of its congeners, rascality in the directorate. Now for the process of working,—£6750 ÷ £15 = 450 shares. The first dividend, paid undoubtedly indirectly out of capital, will be £6750 ÷ 8 (12½ per cent. being ⅛) = £843 15s., and the second 450 times 2s. 6d. = £56 5s.; hence the two years' dividends = £900. Again, £2 10s. × 450 (shares) = £1125, the wreckage secured on selling out; then £1125 + £900 = £2025, total obtained from the Diddlem for the £6750 invested two years ago. £2025 ÷ 16 = 126 9/16

number of shares purchased in the Northport Pier, and 7½ per cent. on £10=15s. the dividend per share; hence $(15s. \times 126\frac{9}{16}) = £\frac{3}{4} \times \frac{2025}{16} = £94$ 18s. 5¼d. Ans.

The above must suffice for Stocks, Shares, etc., space in the PRACTICAL TEACHER becoming monthly, I am reminded, of increased value. The same remark must apply to percentages generally, as, although there are other various miscellaneous operations coming under the term percentages, there can be little difficulty in dealing with them if the principles and working of the six subdivisions (*a* to *f*) have been fairly grasped.

Having gone over the ground, which may be fairly considered as an ordinary curriculum in arithmetic, at least for elementary schools, I am happy to congratulate myself and my readers, that though this paper has been protracted to an unconscionable length—very far beyond my original intention, but which I found far easier to amplify than to curtail—the end is now distinctly 'within measurable distance.' There are, however, a few supplementary principles and processes which ought not to be entirely omitted. The first we will consider are *Proportionate Parts* and *Equation of Payments*, both really being the same in principle. Without any preliminary remarks, we will at once proceed with a few examples.

1st Example. Divide £85 among 4 boys in the ratio 1, 2, 3, 4. I should first explain clearly what the question means—that for every £ or *s.*, or whatever sum of money the first boy gets, the second is to have twice as much, the third three times as much, and the fourth four times as much. I should take 4 boys, and give to the first 1 article (say a marble), to the second 2, to the third 3, and to the fourth 4. I should now elicit that I have given 10 marbles, of which the first boy has got 1, that is, $\frac{1}{10}$ of the lot, the second $\frac{2}{10}$, or $\frac{1}{5}$ of the lot, etc. Or, in another phase of the question, that the second boy will get twice as much as the first, the third 3 times as much, and the fourth 4 times as much. Hence $\frac{1}{10}$ of £85 = £8 10s. the first boy, £8 10s. × 2 = £17 the second, £8 10s. × 3 = £25 10s. the third, and £8 10s. × 4 = £34, the fourth boy. Now show that the sum of these 4 shares is £85, and that their ratio to each other fulfils the conditions given—(say) that the third has as much as the first and second, that the fourth has twice as much as the second, etc.

2nd Example. £12,540 has to be divided between A, B, and C, so that A shall receive three-sevenths of B's and C's shares, B shall receive two-ninths of A's and C's; find the share of each. (*S.* G. Q., No. 284.) First, I would premise that it is somewhat anomalous to divide '*between*' *three* persons, but the language is not mine, but that of the Education Department, as given *verbatim et literatim* to male students in 1876. I have seen many good arithmeticians, both scholars and p. ts., puzzled with this question, they complaining that there is nothing to get hold of, every avenue being seemingly closed. A gets ⅜ of B's and C's shares, and supposing B and C get £7 between them, then A will get £3, hence out of every (£3 + £7) £10 given among them, A will get £3, or $\frac{3}{10}$ of the amount. Hence $\frac{3}{10}$ of £12,540 = £3762, A's share. Again, supposing A and C to receive £9 between them, then as B gets $\frac{2}{9}$ of what they together get, he will receive $\frac{2}{9}$ of £9 = £2. Consequently, out of £11 (£9 + £2) distributed among the three, B will get £2, or $\frac{2}{11}$ of the whole, then $\frac{2}{11}$ of £12,540 = £2280, B's share. C's is easily got, the other two being obtained, £12,540 − (£3762 + 2280) = £6498, C's share. Ans. In class teaching every step of the above should be recapitulated two or three times.

3rd Example. Apportion £932 1s. 10½d. among A, B, and C, so that A's share may be to B's as 1 : 1½, and B's to C's as 1 : 1¼. (*Mansford*, No. 8 in Ex. 68.) A's share is to B's as 1 to 1½, that is, as 2 to 3; and B's is to C's as 1 to 1¼, that is, for every (say) £2 A gets, B gets £3, and as C gets 1¼ to B 1, that is, 1¼ times as much as B gets, then for every £3 B gets, C will get £3 × 1¼ = £3¾. Hence their respective ratio is 2, 3, 3¾, that is, clearing of the fraction, 8, 12, 15; and as the total of these is 35, then A will get $\frac{8}{35}$ of £932 1s. 10½d. = £213 1s.; B 1½ times as much = £319 11s. 6d.; and C gets 1¼ times B's = £399 9s. 4½d. Ans. Or, as an alternative method, having got the sum of the ratios = 35, then $\frac{1}{35}$ of £932 1s. 10½d. = £26 12s. 7½d., which, multiplied respectively by 8, 12, and 15, will give the three shares as above. The most difficult point is getting C's share in ratio with the *two* others, which should be well explained.

4th Example. A, B, and C are sent to empty a cistern by means of two pumps of the same bore. A and B go to work first, making 37 and 40 strokes respectively a minute; but after 5 minutes they make each 5 strokes less a minute, and after 10 minutes more A gives way to C, who works at the rate of 30 strokes a minute. The cistern is emptied in 22 minutes altogether, and the men are paid 12s. 7d. for their labour. What should each receive? (*Colenso*, No. 19, Ex. 68.) As both the pumps are of the same bore, and all the strokes are supposed to be equally effective, each man must be paid according to what ratio his strokes bear to those of his two colleagues. We will first find the number of strokes given by each.

A's are	$(37 \times 5) + (32 \times 10)$	= 505
B's ,,	$(40 \times 5) + (35 \times 17)$	= 795
C's ,,	30×7	= 210
Total strokes given ...		1510

Again, 12s. 7d. = 151d., hence it is obvious that $\frac{1}{10}$d. is paid for each stroke; then A receives 505-tenths of a penny = 50½d. = 4s. 2½d., B 795 = 79½d. = 6s. 7½d., and C 210 = 21d. = 1s. 9d. Ans. To a class I should read the question again carefully, and reconsider each step taken.

We will next consider briefly the doctrine of *Averages*, as it occupies such a prominent position in all statistics, of whatever kind, and is becoming increasingly important in the educational world. Before I attempt a definition of 'average,' I cannot resist the temptation to relate an incident that came under my own observation some fifteen years ago. In a reading lesson in the second standard, which I was teaching, the word 'average' occurred, and asking what it meant, a boy promptly replied, 'What hens lay on.' Thinking I had misunderstood him, I asked him again, when he unhesitatingly gave me the same reply. On further inquiry, I found he had got his idea from a question in my 'Exercises on Arithmetic,' No. 219, simple multiplication and division, old series, which reads as follows:—'If hens, on an average, lay 4 eggs a week, how many eggs will 720 hens lay in 5 years of 52 weeks each?' This taught me a lesson on the importance of children in the lower standards even

having some correct notion of the meaning of the words they read.

Average may be defined as an equalization, real or imaginary, of a series of different numbers. Supposing one boy has 2 marbles and another 4, if they were equalized, each would get 3. Again, three boys have respectively 11, 17, and 29 marbles; find the average. Here the total is 57, which, equally divided among the 3 boys, gives 19 each. We will work out two questions from *Colenso*:—

1st Question. At a competitive examination there were four candidates at the age of 19, 3 at 20, 2 at 21, and 3 at 23; find the average age. We will first find the aggregate age of the whole 12 candidates—$19\times4=76$, $20\times3=60$, $21\times2=42$, $23\times3=69$, giving a total of 247 years. Then $247\div12=20\frac{7}{12}$ years. Ans. The process is easily understood, requiring little explanation. This, as an *absolute* result, is, however, more or less fallacious, as it is assuming—what is exceedingly improbable—that their respective ages were *exactly* 19, 20, etc., not a month or even a day over the completed year. Of course, the average age would really be more if the supplementary months or days were reckoned, but as a *relative* comparison between different batches of candidates, it would answer the purpose.

2nd Question. The average of twenty-one results is 61, that of the first eight being 64, and of the next eleven 59. Required the average of the last two. First, $64\times8=512$, the total of the first eight, and $59\times11=649$, the total of the next eleven; then, $512+649=1161$, the total of the first nineteen, but $61\times21=1281$, the total of the whole twenty-one; hence, $1281-1161=120$, the total of the last two, and $120\div2=60$. Ans. From the working of the above examples we deduce the general rule—divide the aggregate of the series given by the number contained in the series.

With the above, I bring my remarks on 'How I Teach Arithmetic' to a close, leaving Involution, Evolution, Duodecimals, etc., as belonging more to the domain of Mensuration. The principle of the two former resting on a knowledge of algebra, and being taught as arithmetic only by rule, which can be found in any treatise on arithmetic, it is unnecessary to go into the subject. Trusting that this lengthy article may have contributed in some slight degree to make the teaching of arithmetic more intelligent and more intelligible, I now bid my patient readers farewell.

(Concluded.)

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The Amended Syllabus of the New Class Subject.—Elementary Science.

BY RICHARD BALCHIN.

THE syllabus of this subject as it now appears in the Code differs very considerably from that presented in the famous 'Proposals.' It was advocated in the columns of this magazine that the teacher be allowed, to a large extent, to draw up his own scheme and submit it for approval to H. M. Inspector. This point has been conceded. The word 'quadruped,' as a term of classification which appeared in the syllabus of the 'Proposals,' and which the PRACTICAL TEACHER also pointed out as being unscientific, has been struck out. Now, the reader of the Code will find that for all practical purposes, no scheme at all is presented. For no one will pretend to say that the list of items now given will furnish even the barest outline of a syllabus; so it may be ignored. The teacher is in fact thrown entirely upon his own resources. Left at perfect liberty to work out his own conception of what it is to teach elementary science. He need think of nothing in the way of limitation, except perhaps the sentence which heads the subject; viz:—'A progressive course of simple lessons, adapted to cultivate habits of exact observation, statement, and reasoning.' This sentence contains a very excellent generalization of the whole purpose of science teaching. 'Exact Observation'; 'Exact Statement'; 'Exact Reasoning.' It is as if Mr. Mundella had said to us teachers:—'Gentlemen, I do not so much care about the particular items of science that you each may decide to take. That may be regulated by the bent of your own individual minds, and by what you conceive to be to the interest of the boys in your own particular localities. What I am most anxious about is that whatever you determine to teach, shall tend to develope in the child the power to observe exactly, to state in words clearly, and to think accurately; but, inasmuch as I am responsible for the proper administration of public funds granted for these educational purposes, I must ask you each to draw up a syllabus, so that our examiners shall know what it is you profess to have done, in order that a test may be applied, to discover whether or no, that particular thing is obtained for which the public pay.' Personally I think the Proposals and the Code constitute an immense step in advance. They combine these two points as effectually as it is possible to combine them; viz:—Liberty to the teacher for the play of his own individuality, and a guarantee on the part of the Department that the purpose for which the education grant is given, is really secured. It will be less possible in future for a teacher to work exclusively for the examinations. Let me for a minute explain what I mean by 'working for the examinations.' Arithmetic occupies the same place in our primary schools as mathematics and logic do in the Universities. The purpose of Arithmetic is to develope certain mental powers. Now the examination teacher cares nothing about 'the development of certain mental powers.' He only thinks of getting his boys to pass. But in future, before the Inspector assesses the 'Special Merit Grant' he will have to inquire carefully whether Arithmetic has been intelligently taught, and such sham educators as examination teachers will be discovered.

With respect to the practicability of taking up this new class subject, I have decided to work upon the following plan:—Standards I. to IV. inclusive form Division I.; Standards V. to VII.

form Division II. In Division I. I shall take, as class subjects, grammar and elementary science. In Division II. grammar and geography. The special subjects in Division II. will be mechanics and botany. The reasons for adopting this plan are: That science will be taught throughout the school, viz., as a class subject in Division I. and as specifics in Division II. I do not take elementary science as a class subject in Division II., because its syllabus would necessarily include many of the items coming under the head 'Mechanics,' and I do not think that the Department would be found willing to pay twice over for the same thing. We introduce geography as a class subject in Division II., else the boys would leave school without having acquired any geographical knowledge whatever. A very good groundwork for the specific subjects can be laid out in the syllabus for the class subject, 'Elementary Science' in Division I.; the boys would then be well prepared to take mechanics and botany when they pass into the upper division. The following is a scheme of science teaching that I have prepared for adoption at Gloucester Road:—

Standard I.—To tell from pictures the names of these animals: ape, kangaroo, ostrich, crocodile, frog, salmon, butterfly, caterpillar, and oyster, with short stories and interesting particulars. Also from pictures or specimens to tell the names of these trees: oak, elm, beech, fir, plane, sycamore, chestnut, and lime.

Standard II.—The general division of animals into backboned animals, and animals without a backbone. The parts of a plant, root, stem, leaves, blossom, fruit; uses of those parts to man and to the plant. Solids, liquids, and gases. Lessons on chalk, coal, iron, cotton, and flax.

Standard III.—The backbone, and the division of vertebrate animals into mammals, birds, reptiles, amphibians, and fish. The parts of a blossom, functions of those parts. Some properties of matter, *i.e.*, elasticity, flexability, friability, expansibility, and compressibility. The stones in the streets (1), flagstones, can be powdered up to sand (sandstones), kerbstones, can be powdered up into different coloured grains (granite). The stones round the windows can be burnt to lime (limestone).

Standard IV.—The heart and breathing organs of a fish, a frog, a crocodile, a bird, and a mammal. Formation of fruits. The mechanical powers, lever, pulley, wheel, and axle, and inclined plane. Thermometer and barometer. The chemistry of air and water, chalk, and the burning of a candle.

It must be borne in mind that I assume the examination by the inspector to be oral only. A written examination would entirely frustrate the aim sought by this science teaching.

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Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.

(1) From seven thousand four hundred and sixty-three, take two thousand six hundred and forty-eight. Ans. 4815.

(2) From six thousand seven hundred and four, take eight hundred and sixty-two. Ans. 5842.

(3) Add together three hundred and seventy-six, nineteen, four hundred and thirty-five, seven hundred and thirty, and four hundred and six. Ans. 1966.

STANDARD II.

(1) From forty thousand and ninety-six, take twenty-four thousand three hundred and ninety-eight. Ans. 15,698.

(2) Multiply fifty-eight thousand four hundred and sixty-nine, by five hundred and eighty-four. Ans. 34,145,896.

(3) Divide sixty-one thousand three hundred and seven, by nine. Ans. 6811 – 8.

STANDARD III.

(1) A father, mother, and two sons, earn altogether £4 per week. The mother earns 6s. 8d., and each of the two sons 18s. a week. What does the father earn a week. Ans. £1 17s. 4d.

(2) From six hundred and three thousand five hundred and eight pounds fourteen shillings and three pence halfpenny, take fifty seven thousand and twenty-nine pounds sixteen shillings and ninepence farthing. Ans. £546,478 17s. 6½d.

(3) Add together seventy pounds sixteen shillings and one halfpenny, one thousand and eighty-five pounds eight shillings and four pence, three hundred and sixty-eight pounds seventeen shillings and sixpence halfpenny, ninety thousand four hundred and eighty pounds and tenpence farthing, and five pounds eleven shillings and sevenpence three farthings. Ans. £91,938 14s. 5d.

(4) Divide 833,032 by 146. Ans. 5705—102.

STANDARD IV.

(1) I gave five five-pound notes in payment of 37 yards of silk, and received £1 13s. 7¾d. change. What was the price per yard? Ans. 12s. 7¼d.

(2) Reduce 39,024 sq. in. to sq. yds. Ans. 30 yds. 1 ft.

(3) Multiply £743 18s. 9½d. by 395. Ans. £293,856 2s. 8½d.

(4) Divide £18,013 2s. 8½d. by 76. Ans. £237 0s. 3½d.—26.

STANDARD V.

(1) If 3 cwt. 1 qr. of sugar cost £1 12s. 1d. What is the value of 10 tons 10 cwt.? Ans. £103 13s. 0$\frac{1}{13}$d.

(2) 55 miles 7 fur. 38 pls. at £4 13s. 4d. per mile. Ans. £261 6s. 1d.
(3) 9605 @ £7 18s. 5½d. Ans. £76,099 12s. 3½d.
(4) 13 tables at 14s. 10d. each.
54 chairs at £2 14s. per dozen.
30 sq. yds. of cloth at 2s. 3d. per sq. yd.
3 men's wages for 3 days, @ 4s. 3d. per day each. Ans. £27 1s. 7d.

STANDARD VI.

(1) I sold 3 cwt. 2 qrs. 19 lbs. of old lead for £5 19s. 10½d. What price per cwt. did I receive for it? Ans. £1 12s. 8d.
(2) If 25 men can reap a field of 85 acres in 12 days, how many men will reap 51 acres in 10 days? Ans. 18 men.
(3) From $\frac{1}{3}\frac{7}{5}$ of 10 cwt. a grocer sold $5\frac{5}{14}$ of 3 qrs., how many lbs. had he left? Ans. 94 lbs.
(4) From $\frac{3}{7}$ of $10\frac{1}{2}$ take $\frac{8}{17}$ and divide the answer by $2\frac{4}{5}$. Ans. $1\frac{4}{7}\frac{8}{1}\frac{6}{8}$
(5) Divide 48,224 by 13·7, also divide 13·7 by 48224. Ans. 3520 and ·00028409.

Botany.

Name as many different kinds of roots as you can, and give examples of each.
What is an adventitious root, and how do you distinguish it from a creeping stem?
Name the flower-leaves of a common buttercup.
How does the flower of a primrose differ from that of a buttercup?
Describe the leaves and stem of a wallflower.

Physiology.

What is meant by the skeleton? What are its uses? Name the bones which form the Pelvis.
Explain how the elbow-joint is worked.
Where are the stomach, the heart, the kidneys, and the pancreas situated?
Describe what evils arise from 'tight lacing.'
What is the alimentary canal?
What are the uses of nerves?
What are arteries and veins? How do they differ?

Dictation.

STANDARDS V. AND VI.

There is a beautiful propriety in the order in which singing birds fill up the day with their pleasing harmony. The accordance between their songs and the aspect of nature, at the successive periods of the day at which they sing, is so remarkable, that one cannot but suppose it to be the result of benevolent design. First the robin (not the lark, as has been generally imagined), as soon as the twilight has drawn his imperceptible line between night and day, begins his artless song.

Practical Lessons on Insect Life.

BY THEODORE WOOD, M.E.S.,
Joint Author of 'The Field Naturalist's Handbook.'

No. XII.—THE LEPIDOPTERA. PART II.

PASSING by several families of moths, we come to the Tiger Moth, an insect more commonly seen in its larval than in its perfect state. It is hardly possible to walk along a country lane in the spring without noticing a colony or two of these caterpillars feeding upon the nettles and other plants growing by the roadside. These larvæ are popularly known as 'Woolly Bears,' owing to the quantity of long hair with which their bodies are thickly covered.

The perfect insect, although very plentiful, is comparatively seldom seen, owing to its retiring habits. It cannot, however, resist the mysterious attraction which artificial light appears to exercise towards many insects, and may often be noticed upon a dark night fluttering wildly around the street lamps, or resting peacefully upon the panes which enclose the source of attraction. It is a very handsome insect, the upper wings being of a rich velvety-brown, intersected with white markings, while the lower pair are generally red, variegated with large blue-black blotches of variable number, size, and form. It would be impossible, however, to write a description which would apply to all specimens of the moth, as the colour and markings vary to a most wonderful extent. Sometimes a tiger moth will be found in which all four wings are of an uniform brown-black hue, scarcely a trace of the ordinary markings being visible. In other cases a creamy white predominates to an almost equal degree, while in less aberrant specimens the form and size of the usual markings vary to an almost inconceivable degree. It would, indeed, be by no means a difficult task to fill a case with a number of examples of this moth, no two of which should exactly resemble one another.

Allied to the tiger moth, although placed in a different family, the Gold-tail Moth next claims our attention. This is a singularly pretty insect, the wings, head, thorax, and the greater part of the body being of a pure satiny-white. The extremity of the abdomen is adorned with a large tuft of golden-yellow hair, from which the insect derives its popular name.

The chief interest of the gold-tail moth centres in the caterpillar, whose body is thickly covered with hairs endowed with a peculiarly poisonous property. If the creature be handled, a number of these hairs are sure to enter the skin, and will leave unpleasant reminiscences of their presence for some little time. At first an intolerable itching is felt in those parts which have been pierced by the poison-bearing hairs. This is speedily followed by the swelling of the affected parts, which sometimes takes place to such an extent that the victim appears as if a number of large potatoes had been introduced beneath his skin.

Some persons are far more severely affected by these 'urticating' hairs, as they are scientifically termed, than others, while a favoured few are entirely unharmed by them. They are not peculiar to the gold-tail larva, for the caterpillars of many other allied insects are similarly endowed, although in a lesser degree.

The larva is a very handsome one, the ground-colour being black, while two interrupted vermilion stripes run longitudinally for the entire length of the

body. It feeds principally upon the whitethorn. The female moth has a curious habit of covering her eggs with a kind of thatch, formed from the tuft of golden hair at the extremity of her body, which she tears off for the purpose.

In the warm, sunny days of August and September a small, brown moth may be seen dashing wildly to and fro with a curiously erratic flight, changing the direction of its course almost every other moment. Even in the smoky squares of London this active little creature may be noticed, revelling in the warm rays of the sunshine.

This is the male Vapourer Moth, really a very pretty insect, the wings being of a rich chestnut-brown, with a white crescent-shaped spot in the anal angle. No one except an entomologist, however, would recognise the female vapourer for a moth at all, for she is a clumsy, grub-like creature, almost entirely destitute of wings, and bearing no resemblance whatever to her active and handsome mate. So large and ungainly is her body in proportion to the size of her limbs that she is quite unable to move a single step, and spends the whole of her existence clinging to the web which contained the pupa from which she emerged. Upon this web she lays her eggs, arranging them in long rows with great regularity, and dying as soon as her task is completed.

It is a curious fact that the eggs of the vapourer moth do not hatch simultaneously, as is the case with those of insects in general, but do so in detachments, a period of eight or ten weeks elapsing between the time in which the first larva makes its appearance and that in which the last of the brood leaves the egg-shell. It is, therefore, by no means unusual to find the insect in all the stages of its development at the same time, a single tree furnishing egg, larva, and pupa, while the perfect insect may be seen fluttering in the neighbourhood.

This is also the case with an allied species, the Oak-eggar Moth, and I have upon more than one occasion had the insect in all its stages in my breeding-cages at one and the same time.

The vapourer moth is a most ubiquitous creature, the larva feeding upon the foliage of almost any tree, or shrub with equal avidity. Fruit trees often suffer greatly from its attacks, and were it not for the labours of the various insect-eating birds, we should probably have to rank the insect among the greatest foes to our kitchen-gardens and orchards.

The Lackey Moth is chiefly worthy of notice on account of the manner in which the female deposits her eggs, for she places them in the neatest possible rings round the twigs of apple-trees.

We now come to the great group of Geometers—*i.e.*, 'step-measurers'—which are so called on account of the peculiar method of walking employed by the caterpillars.

It will be remembered that, as a general rule, the larvæ of the lepidoptera are provided with ten false legs, or claspers, in addition to the six true limbs which are possessed by every insect. In the geometers, however, four only of these claspers are found, these being placed at the extremity of the body. Owing to this structure, the larvæ of these moths are obliged to proceed in a very peculiar way, and do so in the following manner :—

Clinging tightly to the twig upon which they are resting with the true legs, they draw the body into a loop, so that the anal claspers are brought into close proximity to the head and legs. A firm hold is then taken with the claspers, and the body stretched out to its full length, when a fresh hold is taken with the true legs. The body is again drawn up as before, and the process repeated as often as required. In consequence of this habit, the larvæ are often called 'Loopers.'

Nearly all the geometer larvæ are protected from the attacks of birds and other enemies by the wonderful resemblance which they bear to the twigs of the food-plant. Many of them have projections upon various parts of the body which are so wonderfully similar in appearance to the young buds that even the most practised eye will often fail to distinguish the larva from the twig upon which it is resting. The attitude assumed in repose aids them greatly in their resemblance to surrounding objects, as the body is almost invariably stretched straight out at an angle from the branch to which the caterpillar is clinging, the claspers alone sustaining the entire weight of the body.

In order to do this, the muscular power must be simply marvellous. One of the most trying feats in gymnastic exercises is to hold the body at right angles to a perpendicular bar by the grasp of the hands alone, and not even the most powerful and accomplished performer can remain in that position for more than a few seconds. Yet, with these caterpillars, this apparently strained and unnatural position seems to be the normal attitude of repose, and can be sustained for hours without the slightest inconvenience.

The geometers comprise a very large number of insects, even in this country, very few of which, however, can be mentioned in this article.

One of these is the very plentiful Gooseberry, Currant, or Magpie Moth, the larva of which often appears in such numbers as to cause very considerable damage to the fruit bushes. This destructive caterpillar may be easily recognised by the cream-coloured body, and the longitudinal reddish-orange stripe running below the spiracles. It is a curious fact that neither toads nor insect-eating birds will touch this caterpillar, which seems to be protected by some flavour which is distasteful to its natural enemies.

Like the tiger moth, the magpie moth is extremely subject to variation in colour and marking, scarcely two specimens being precisely similar. The ground-colour of the wings is generally a creamy white, while a number of black blotches of uncertain size and form are distributed over their surface. There is generally a bent transverse band of yellow beyond the middle of the fore-wings, their bases being also adorned with a yellow blotch. Sometimes, however, specimens will be found in which the black markings usurp almost the whole of the wings, while in other examples their position is only faintly indicated, white being the predominant hue.

A far more destructive insect now claims our attention, fruit trees of various kinds suffering greatly from its ravages. This is the Winter Moth (*Cheimatobia brumata*), which, unlike insects in general, makes its appearance upon the wing at a time when insect life is conspicuous by its absence.

Upon any mild evening in December or January, we may see a number of delicate, light-brown moths fluttering round every lamp-post, in their vain attempts

to discover the mystery of the flame. These are the male winter moths, the female being possessed of only the merest rudiments of wings. In general form, indeed, she is not unlike a spider, and is able to run about the tree-trunks with considerable activity.

Her eggs are deposited in the crevices of the bark of various fruit trees, such as the apple, pear, plum, quince, etc., the young larvæ hatching in early spring, and at once making their way into the, as yet, unopened buds. At this period of their existence vast numbers are destroyed by titmice and other small birds, which, however, according to the late Mr. E. Newman, do not appear to discriminate with sufficient care between the sound and the damaged buds. When the leaves are a little more advanced, the grubs emerge from their domiciles, and spin two or three together, in order to form a refuge in which they are concealed from the sight of their numerous foes, and which they only partially leave when engaged in feeding. In May they are full-fed, and then descend to the ground in order to undergo their change to the pupal condition.

In order to rid the orchards as far as possible of the pest, Mr. Newman recommends that each tree should be painted with a mixture of Stockholm tar and cart-grease, laid on in a circular belt. This composition does not injure the tree, and captures the female moths in great numbers as they ascend the trunks in order to deposit their eggs. The application must be renewed once in four or five days or so, and also after a frosty night, which causes it to harden, and so renders it useless.

An inspection of the trees after dark by the aid of a lantern is also recommended, in order that any moths which had taken up their abode in the branches before the sticky mixture was applied might be detected and killed before they had an opportunity of depositing their eggs.

Yet, even if every precaution be taken, more or less damage is sure to be caused in every orchard by this destructive moth, which we must certainly rank as one of the most mischievous of our insect foes.

Omitting, from lack of space, the next group of moths, we come to the large division of the *Noctuæ*, or Owl Moths, so called because they fly almost exclusively by night. Of these, more than three hundred species inhabit Great Britain, while the group is very largely represented in other parts of the world.

One of the earlier species of these, the Peach-blossom, must be mentioned merely for the sake of its marvellous beauty, each of the upper wings being adorned with five pink spots of the exact form and hue of the petals of the peach. The ground-colour is a rich olive-brown. A prettier insect could hardly be imagined, and, as far as the British *noctuæ* are concerned, the peach-blossom certainly bears away the palm in point of beauty. In some places it is fairly plentiful, while in others it is seldom or never seen.

To this group belong also the destructive Turnip Moth (*Agrotis segetum*), and the equally mischievous Cabbage Moth (*Mamestra brassicæ*), both of which are among the direst foes of the agriculturist. The former is perhaps the more to be dreaded of the two, as the ravages of the larva take place beneath the ground, where its presence is not easily to be detected. It does not hibernate, or pass the winter in a state of torpid inaction, but continues to feed as before.

But very few of the *noctuæ* are of interest to any but professed entomologists, their habits and mode of life being very obscure, and only a very small proportion exercising any influence, direct or indirect, upon man himself. An exception to the general rule, however, is the Silver Y Moth (*Plusia gamma*), which scarcely any resident in the country can have failed to notice. It is almost unique among the lepidoptera in its habit of flying both by day and night, sporting round various flowers in the sunshine, and visiting the street-lamps after darkness sets in.

In the summer of 1879 a vast immigration of this insect took place in this country as well as in other parts of Europe. The moth was everywhere to be seen in countless numbers, flying up in thousands in every direction as one passed along, and sometimes almost bewildering one by its wonderful abundance. In other parts of Europe the insect was found in the same extraordinary plenty, and the swarm seems even to have extended to certain districts upon the African continent.

The name 'Silver Y' has been applied to this moth on account of the peculiar silver mark upon the fore-wings which closely resembles the English letter Y, or the Greek letter gamma (γ). Another moth of the same genus, the Golden Y (*P. iota*), has a mark of similar form, but of a golden instead of a silver hue. The whole genus is remarkable for the bright metallic patches which are found upon the wings of all the members, but which vary very greatly in form and colour in the different species.

The last *noctua* which we can mention is the handsome Red Underwing, a plentiful insect in the southern counties of England. When at rest, it is a comparatively commonplace insect in appearance, the markings of the upper wings being merely composed of a rather curious admixture of several shades of grey and brown. When the wings are spread, however, the full beauty of the moth is disclosed, the bright red under-wings affording a rich contrast to the grey and brown of the upper pair.

Except in flight, however, these wings are never shown, and the upper wings harmonize so exactly with the hues of the tree trunks upon which the insect generally rests, that it is perfectly invisible to any but the most practised eye. The moth is rather a large one, being rather more than three inches in spread of wing.

Next come a large number of moths, comprised in several families, which are collectively known as '*Micro-Lepidoptera*,' on account of the small size of most of the members. With the exception, perhaps, of the Clothes Moth, which is only too familiar an insect to most of us, very few of these moths possess any general interest, and there is none amongst them which need be especially singled out for description. We will therefore bid adieu to the lepidoptera, and proceed, in the following paper, to the next order of insects, namely, the *Homoptera*.

(To be continued.)

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ANSWERS TO
Pupil Teacher's Examination Paper.
MARCH 25TH, 1882.
CANDIDATES.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. Find, by Practice, the cost of 5 bins of oats, each containing 7 quarters, 7 bushels, 3 pecks, at £1 8s. 8d. per quarter.

7 qrs. 7 bu. 3 pks. × 5 = 39 qrs. 6 bu. 3 pks.

		£	s.	d.
Value of 1 qr.	=	1	8	8
				39
,, 39 qrs.	=	55	18	0
,, 4 bu. = ½ val. of 1 qr.	=		14	4
,, 2 bu. = ¼ ,, 4 bu.	=		7	2
,, 2 pks. = ¼ ,, 2 bu.	=		1	9½
,, 1 pk. = ½ ,, 2 pks.	=			10½
,, of the 5 bins	=	57	2	2½ Ans.

2. A bankrupt pays up £2,284 4s. 9½d., being at the rate of 12s. 10½d. in the £ of his debts. What was the amount of his debts?

12s. 10½d. : £2,284 4s. 9½d. :: £1 : amt. of debts.
or or
309 halfd. : 1096435 halfd.

$$\frac{£1 \times 1096435}{309} = £3548\ 6s.\ 8d.\ \text{Ans.}$$

3. If 48 lbs. of wool make 230 yds. of cloth, 1 yard wide, how much cloth, 1¼ yds. wide, ought 36 oz. to make?

48 lbs. : 2¼ lbs.
1¼ yds. : 1 yd. } :: 230 yds. : length required.

$$\frac{230 \text{ yds.} \times 9 \times 4}{192 \times 5} = \frac{69}{8} = 8 \text{ yds. } 2 \text{ qrs. } 2 \text{ nls. Ans.}$$

4. A parish, containing 960 acres, is rated on a rental of £2,040; a rate of 8d. in the £ is levied. What, on the average, is the charge per acre?

8d. = $\frac{1}{30}$ of £1 ∴ the rate on the whole = $\frac{1}{30}$ of £2,040 = £68.
£68 ÷ 960 = $\frac{1360}{960}$s. = 1s. 5d. charge per acre. Ans.

FEMALES.

1. Make out the following bill:—

27¼ lbs. Hyson tea at 5s. 11¼d. per lb.
46¾ lbs. Bohea tea at 3s. 11d. per lb.
25½ lbs. Mocha coffee at 2s. 2d. per lb.
17⅞ lbs. Demerara coffee at 1s. 4d. per lb.
105¼ lbs. sugar at 6¾d. per lb.
256 lbs. rice at 2½d. per lb.
18¾ lbs. ham at 8d. per lb.
59⅛ lbs. ham at 6½d. per lb.

		s.	d.		£	s.	d.
27¼ lbs.	at	5	11¼	per lb. =	8	3	10½
46¾	,,	3	11	,, =	9	3	1¾
25½	,,	2	2	,, =	2	14	5½
17⅞	,,	1	4	,, =	1	3	6
105¼	,,	0	6¾	,, =	2	19	3
256	,,	0	2½	,, =	2	8	0
18¾	,,	0	8	,, =	0	12	6
59⅛	,,	0	6½	,, =	1	12	4½
					£28	17	0½ Ans.

2. Find the value of 46,584 articles at £8 17s. 3½d. each.

	£	s.	d.
(*a*) Value of 46,584 at £9 each =	419,256	0	0
(*b*) Deduct value of 46,584 at 2s. 8½d. each.			
Value of whole at £1 =	46,584	0	0
,, at 1s. 8d. = ⅓ at £1 =	3,882	0	0
,, at 1s. 0d. = ⅓ ,, =	2,329	4	0
,, at 0s. 3½d. = 1/96 at 1s. =	145	11	6
=	6,356	15	6
∴ 46,584 at £8 17s. 3½d. =	412,899	4	6

3. What is the cost of 374 qrs. 7 bus. 2 pks. of wheat at £2 3s. 8d. per quarter?

		£	s.	d.
Value of 1 qr.	=	2	3	8
				374
,, 374 qrs.	=	816	11	4
,, 4 bus. = ½ val. of 1 qr.	=	1	1	10
,, 2 ,, = ½ ,, 4 bus.	=	0	10	11
,, 1 ,, = ½ ,, 2 ,,	=	0	5	5½
,, 2 pks. = ¼ ,, 1 ,,	=	0	2	8¾
,, of 374 bus., etc.	=	818	12	3¼ Ans.

4. The driving wheel of a locomotive engine is 15½ feet in circumference; how many times will it revolve between Edinburgh and Glasgow, the distance being 46½ miles?

15½ ft. = 46 thirds of a foot.
46½ miles = 5,280 ft. × 46½ = 245,520 ft. = 736,560 thirds of a ft.
736,560 ÷ 46 = 16,012⅔ times.

Grammar.

1. 'Full oft the rescued boy she kissed,
And often pressed him to her breast;
For under all her dauntless show,
Her heart had throbbed at every blow;
Yet not Lord Cranstoun deigned she greet,
Though low he kneeled at her feet.'—SCOTT.

Parse all the verbs and adverbs in the above.

full—adv. of deg., mod. *oft*.
oft—adv. of time, mod. *kissed*.
kissed—trans. verb, reg., indic., past indef., 3rd pers. sing., agr. with *she*.
often—adv. of time, mod. *pressed*.
pressed—trans. verb, reg., indic., past indef., 3rd pers. sing., agr. with (*she*).
had—past indef., indic. of auxiliary verb *have, had, had*, forming with the complete part. of the reg. intrans. verb. *throb*.
had throbbed—past perf. indic., 3rd pers. sing., agr. with *heart*.
not—adv. of negation, mod. *deigned*.
deigned—intrans. verb, reg., indic., past indef. 3rd pers. sing., agr. with *she*.
(*to*) *greet*—trans. verb., reg., infin. pres., indef. gov. by *deigned*.
low—adv., mod. *kneeled*.
kneeled—intrans. verb, reg, indic., past indef, 3rd pers. sing., agr. with *he*.

2. Compound verbs are sometimes made up of the auxiliary and the participle, sometimes of the auxiliary and the infinitive mood. Give example of each kind.

In the compound verb the auxiliaries *have* and *be* are followed by the *participle:* as 'I have gone,' 'it had throbbed,' 'he was pressed.'

The auxiliaries *shall* and *will* are followed by the *infinitive:* as 'I shall (to) go,' 'they will (to) run,' 'she should (to) have gone.'

3. How are adverbs compared for the most part? Give examples of some adverbs that are exceptions to the common rule in this respect.

Adverbs are for the most compared by means of the adverbs *more* and *most:* as *nobly, more nobly, most nobly*. They are also compared by adding 'er' and 'est': as *often, oftener, oftenest*. The following are exceptions to the foregoing rules:—*well, better, best; bad'y, worse, worst; near, nearer, next; far, farther, farthest; much, more, most.*

Geography.

Answer two Questions.

1. Describe a coasting voyage from Southampton to Bristol.

If you can, draw a map of this portion of the coast.

Sailing from *Southampton*, a great packet station, we skirt the coast of the *Isle of Wight*, which has been called the garden of England, navigate the channel called the *Solent*, and observe the *Needles*, the western termination of the Isle of Wight. The coast now curves round to *Poole Harbour*, south of which is the *Isle o Purbeck*, with its limestone known as Purbeck marble.

After passing *St. Alban's Head* we reach Portland Bill, with excellent building stone, and as we describe the curve round to *Start Point*, we meet with *Lyme Regis*, *Torbay*, *Torquay*, *Dartmouth*, and reach *Plymouth*, noted for its gigantic breakwater, with Eddystone Lighthouse to the south. As we continue towards *Lizard Point* we note *Falmouth*, a packet station, and *Mount Bay*, so named from St. Michael's Mount, situated in it. *Penzance*, noted for its mild climate, lies near *Land's End*. Proceeding north-east, we round *Hartland Point* into *Bideford Bay*, with *Lundy Isle* on our left. Continuing easterly we reach our destination, *Bristol*, the fourth seaport of England.

2. The subject for a prize theme at a school was:—

"*What county of the British Islands contains the most beautiful scenery? Give a description of it.*" Four boys tried for the prize, one born in Cumberland, one in Carnarvonshire, one in Perthshire, and one in Kerry; and each chose his own county. What did each find to say?

Cumberland is composed of three distinct parts: the south-western half is very mountainous, containing the greater portion of the Cumbrian hills; the north-eastern part is formed of the slopes of the Pennine moorlands; and between the two lies a broad and fertile plain, the lower valley of the Eden. This county contains the highest mountains in England, and most of the English lakes, which are the more remarkable as being the only large sheets of water throughout the whole country, and give to this region the name of the *Lake District*. These lakes lie in a somewhat regular order, occupying long narrow valleys, which are ranged round the centre of the group, Helvellyn, and radiate from it outwards like the spokes of a wheel. In the midst of the lakes, a little to the west of Helvellyn, lies the high central valley of Borrowdale, shut in on every side by closely encircling hills, and very famous for the beauty of its scenery. The industries of the county are limited to sheep-farming, and the working of one or two lead mines; but the character of the rocks, soil, and climate, which have limited its means of wealth, have at the same time given to it a beauty in which it surpasses all other parts of England.

Carnarvonshire consists exactly of the rugged mass of the Snowdon range, and the sharp spur of rocks which run southward from it to the sea. The mountain masses which constitute the county form a bleak and inhospitable region. The wild and rugged scenery of this district, however, surpasses in grandeur any other mountain scenery south of the Tweed. The chief resources of the county lie in the rocks of which its mountains are composed. The central mountain of the range is Snowdon, whose five peaks of nearly equal height rise 3,590 feet above the sea level, and from their position and elevation determine the river system of the surrounding district. To the north the lower spurs of the mountain form the Pass of Llanberis, beyond which lies a group of heights almost as lofty as Snowdon itself, and all these summits are higher than any in England.

Perthshire is about equally divided between the mountains and the plain, forming a vast irregular circle almost exactly coinciding with the basin of the Tay. Occupying a most important geographical position, it is the only Highland county which lies wholly inland, and includes not only the bulk of the rich fields of Strathmore, but also every one of the main passes that lead from the Lowland plain into the centre of the Highlands. The mountainous districts of Perthshire consist of a series of ridges which are marked by great masses of mountains, ranging from 3,000 ft. to 4,000 ft. in height. The southern heights are not so high, but are well known for the famous gorge of the Trossachs, formed by spurs at the approach to Loch Katrine from the Lowland plain. Among these mountain ridges are enclosed the greater number of the vast circle of Highland lakes. The whole of this district, in fact, with its massive mountains, its lakes, its torrents, and its rocky glens, forms a scenery whose picturesqueness is unrivalled in Britain. A few hamlets and villages lie here and there in the river valleys, and are well known for the grandeur of the surrounding scenery. Such are Blair Athol and Pitlochrie, which, at either extremity of the Pass of Killiecrankie, command the road to northern Scotland, through the mountains up the valley of the Garry.

Kerry, bordered by the Atlantic, is deeply indented by bays, between which lie peninsulas, forming the western extremities of that mountain system which crosses the entire south of Ireland. The mountain knot, called Macgillicuddy's Reeks, contains Carntual 3,410 ft., the highest summit in Ireland. Mountain ridges, bounding valleys, of greater or less width, form the distinguishing features over the greater part of Kerry. The scenery of Kerry most attractive to tourists lies round the Lakes of Killarney, which merit a full description. The Upper Lake, a beautiful sheet of water, is enclosed on all sides by mountains, except at its eastern point, where it discharges its waters by a tortuous course of three miles. A channel leading from the upper to the lower lake passes through a thickly-wooded defile, and about midway between the extremities of this channel, a remarkable detached rock, called the Eagle's Nest, rises 1,100 feet high. Emerging from this defile the river expands into the Lower Lake of Killarney, bounded on its western side by mountains covered with rich natural woods, from a height of several hundred feet down to the water's edge, through a continuous distance of six miles. O'Sullivan's River forms a cascade 70 feet high, close to the shore of the lake. The opposite side is everywhere broken by promontories and islands, and the town of Killarney is situated on the plain, about a mile from the eastern shore. It presents a very animated appearance in summer, from the influx of visitors to the Lakes.

Composition.

Write from dictation the passage given out by the Inspector.

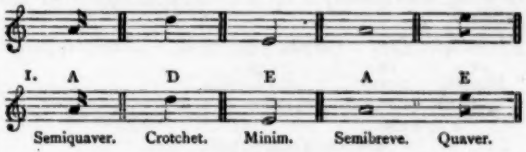
Penmanship.

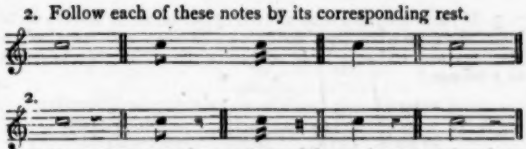
Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy.*

Music.

A quarter of an hour allowed for this Paper.

1. Write over each of the following notes its pitch name (C, D, *Do*, *Re*, or other), and under each its duration name (crotchet, quaver, or other).

2. Follow each of these notes by its corresponding rest.



3. Supposing we make one beat while we sing a crotchet, how many shall we make while we sing a semibreve?

3. If we make one beat while we sing a crotchet, we shall make *four* beats while we sing a semibreve, because a semibreve is equal in duration to four crotchets.

FIRST YEAR.

Pupil Teachers at end of First Year.

Three hours and a-half allowed.

Arithmetic.

MALES.

1. How many apples must be cut up in order to give to each of 19 children one third of an apple? and what would the apples cost at the rate of 1s. 9d. per doz.?

To give $\frac{1}{3}$ to each will require $\frac{1}{3}^2 = 6\frac{1}{3}$ app'es.
$\therefore$ 7 apples are required; and at 1s. 9d. per dozen, they will cost $\frac{7}{12}$ of 1s. 9d. = 1s. 0½d. Ans.

2. Reduce to their lowest terms $\frac{11}{13}\frac{7}{9}$, $\frac{13}{17}\frac{9}{11}$; and to simple fractions $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$, and $7\frac{1}{2}$ of $5\frac{1}{3}$ of 11.

(*a*) G. C. M. of 240 and 875 is 5 $\therefore$ $\frac{11}{13}\frac{7}{9} = \frac{17}{17}\frac{5}{5}$. Ans.
(*b*) „ 425 and 646 „ 17 $\therefore$ $\frac{13}{17}\frac{9}{11} = \frac{1}{1}$. Ans.

(*c*) $\frac{1}{3}$ of $\frac{2}{7}$ of $\frac{1}{11} = \frac{1 \times 6 \times 14}{2 \times 7 \times 33} = \frac{2}{11}$ Ans.

(*d*) $7\frac{1}{2}$ of $5\frac{1}{3}$ of 11 $= \frac{15 \times 31 \times 11}{2 \times 6 \times 1} = \frac{1705}{4}$ Ans.

3. By how much is $1\frac{1}{6}$ of 1 ton 11 lbs. greater or less than $3\frac{3}{4}$ of 11 cwt. 6 lbs.?

	cwt.	lbs.		cwt.	lbs.
(*a*) $3\frac{3}{4}$ of 11 cwt. 6 lbs. =	11	6	$\times \frac{15}{4} =$	37	$65\frac{1}{2}$
(*b*) $1\frac{1}{6}$ of 1 ton 11 lbs. =	20	11	$\times \frac{31}{6} =$	31	$29\frac{5}{6}$
∴ (*b*) is less than (*a*) by				6	$35\frac{2}{3}$ Ans.

4. Compare the values of ·785 of £1·3, and ·875 of a guinea.

(*a*) ·785 of 26$\frac{2}{3}$s. $= \frac{\cdot 785\text{s.} \times 80}{3} = 20\cdot 93$ s.

(*b*) ·875 of 21s. $= \cdot 875\text{s.} \times 21 = 18\cdot 375$

∴ (*a*) is greater than (*b*) by $2\cdot 5583$s. = 2s. 6·7d.

FEMALES.

1. A bankrupt whose debts amount to £7586 11s. 6½d. compounds with his creditors for 13s. 7½d. per pound; how much will they lose by him?

	£	s.	d.	
Debts =	7586	11	6½	
Loss of 5/- per £ = ¼ of debts =	7896	12	10½	or $\frac{2}{3}\frac{8}{2}\frac{8}{0}$
,, 1/3 ,, = ¼ of 5/- loss =	474	3	$2\frac{1}{2}$	or $\frac{1}{3}\frac{9}{2}\frac{5}{0}$
,, 1½d. ,, = $\frac{1}{10}$ of 1/3 loss =	47	8	$3\frac{1}{2}\frac{7}{0}$	
,, 6s. 4½d. per £ =	2418	4	$5\frac{37}{40}$	

2. If £35 8s. 4d. be the price of 110 yds. 3 qrs. 2½ nls. of carpeting, what quantity of the same could be bought for 100 guineas?

£35 8s. 4d. : £105 :: 110 yds. 3 qrs. 2½ nls. : quantity required.
or or or
8500d. 25200 3549 half nls.

$\frac{3549 \text{ nls.} \times 25200}{2 \times 8500} = \frac{3549 \text{ nls.} \times 126}{85} = 5260\frac{1}{2}$ nls. =
328 yds. 3 qrs. $0\frac{1}{2}$ nls. Ans.

3. If 72 women can reap a field of 30 acres in 4 days of 12 hours each, in what time could 54 men reap 120 acres, when the days are 10 hours long, supposing 3 men to reap as much as 4 women?

4 women's = 3 men's work } not required therefore
∴ 72 ,, = 54 men ,, } in working sum.
30 acres : 120 ac. :: 48 ho. : hours required.

$\frac{48 \text{ ho.} \times 120}{30} = 192$ ho., or 19 days 2 hrs. (da = 10 ho.)

4. If a garrison of 2,800 men in 45 days at 20 ounces each per day, consumes a certain value of bread when the 4-pound loaf is at eightpence; how many men will four times the value serve for 56 days, at 16 ounces each per day, when the same loaf is at 7½d.?

56 days : 45 days
16 oz. : 20 oz.
7½d. : 8d.
1 value : 4 times value
} :: 2,800 men : No. required.

$\frac{2800 \text{ men} \times 45 \times 20 \times 16 \times 4}{56 \times 16 \times 15 \times 1} = 12{,}000$ men. Ans.

Grammar.

1. 'Whom I most hated living, thou hast made me,
With thy religious truth and modesty,
Now in his ashes honour.'—SHAKESPEARE.

(*a*) Parse the pronouns in the above.

(*b*) What is 'whom' equivalent to in the above? Compare its use with the way in which the word 'what' is often used.

(*a*) *Whom*—simple rel. pron. 3rd pers. sing. mas. (having a forward reference to *his* in third line), obj. gov. by *hated* and *honour*.
I—personal pron. 1st pers. mas. (or fem.) sing. nom. subj. of *hated*.
thou—pers. pron. 2nd pers. mas. or fem. sing., nom. subj. of *hast*.
me—pers. pron. 1st pers. mas. or fem. sing. obj. gov. by *made*.
thy—pron. poss. adj. attrib. to *truth* (or, poss. case of *thou*).
his—pron. poss. adj. attrib. to *ashes* (or, poss. case of *he*).

(*b*) 'Whom' is equivalent to 'him whom.' The word 'what' when used as a relative, has its antecedent similarly suppressed, as, I did what you ordered, where 'what' equals that which. It is not usual nowadays to suppress the antecedent to *who*.

2. Give the possessive case of each of the following pronouns:—Thou, He, She, Who, They.

Thou has for possessive 'thy' or 'thine.'
He ,, 'his.'
She ,, 'hers' or 'her.'
Who ,, 'whose.'
They ,, 'their' or 'theirs.'

3. Into what different classes may prepositions be divided according to their etymology (derivation). Give examples of prepositions in each class.

Prepositions may be classed as follows:—
1. Simple: as—at, by, in, on, up.
2. Compound and Derivative: as—before, around, saving, within.
3. Phrase-prepositions: as—instead of, along with, for the sake of.

Geography.

Answer two Questions.

1. Say what you know about the striking physical features of Cumberland, Carnarvonshire, Perthshire, and Kerry.
Draw little sketch maps to illustrate your answer.
(See answer to No. 3, Candidates).

2. Draw a full map of Germany.
(See any good atlas.)

3. Name six important towns in France (*not* including Paris), and say fully what you know of each.

Lyons—at the junction of the Rhone and Saone; second city in population and commercial importance; first in manufacturing industry, silk especially.

Marseilles—most ancient city in France, third in regard to population; its commerce in fruits and wines extends to all parts of the world.

Bordeaux—largest and most important city in the west of France, the third commercial port, is the great emporium of the wine trade, and one of the principal seats of its foreign commerce.

Lille—a very strongly fortified city, is one of the chief seats of the cotton, linen, and woollen manufactures.

Toulouse—the most important and populous city in the entire south of France; a southern centre for literature and science, contains the principal cannon-foundry in France.

Nantes—one of the largest and most commercial cities in the west of France, with extensive shipbuilding docks.

History.

1. Give the dates of Egbert, Athelstan, Canute, and Edward the Confessor; and name their immediate successors.

	A.D.		
Egbert, crowned king of all England	827,	suc. by	Ethelwulf.
Athelstan ,, ,,	925,	,,	Edmund I.
Canute ,, ,,	1017,	,,	Hardicanute.
Edward (Confessor) ,,	1042,	,,	Harold II.

2. When did William II., Henry II., Edward II., and Richard II., cease to reign? and who succeeded them?

	A.D.		
William II. ceased to reign	1100,	succeeded by	Henry I.
Henry II. ,, ,,	1189,	,,	Richard I.
Edward II. ,, ,,	1327,	,,	Edward III.
Richard II. ,, ,,	1399,	,,	Henry IV.

3. Write down the names and dates of our sovereigns from Charles II. to George II. inclusive.

	A.D.		A.D.
Charles II.	reigned from	1660	to 1685
James II.	,,	1685	,, 1688
William III. and Mary II. (died 1695)	,,	1689	,, 1702
Anne	,,	1702	,, 1714
George I.	,,	1714	,, 1727
George II.	,,	1727	,, 1760

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Music.

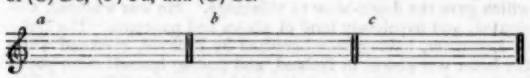
A quarter of an hour allowed for this Paper.

1. What is meant by a *sound*, what by a *tone*; and how does a sound differ from a tone?

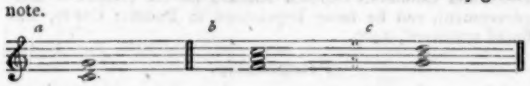
1. *Sound* is the effect on the ear of the vibration of the air caused by some disturbing force. When the vibration is regular the result is a *musical* sound.

A *tone* is the interval between two sounds, either higher or lower, and can be divided into two semitones. The natural scale has eight sounds, rising in successive steps by tones and semitones, the latter being found between the third and fourth, and seventh and eighth sounds.

2. What is a *triad*? Write in *a*, *b*, and *c* severally the triads of (C) Do, (F) Fa, and (G) Sol.



2. A *triad* is the addition of its third and fifth to any given note.



3. How many tones and how many semitones are found in the diatonic scale, and what are the places in it of the latter?

3. In a diatonic scale are found five tones and two semitones, the latter being found between the third and fourth, and seventh and eighth notes.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. Find the simple interest on £6,901 for 292½ days at 3½ per cent. per annum.

$$\text{Simple int.} = £6901 \times \frac{292}{365} \times \frac{3\frac{1}{2}}{100} =$$
$$= £\frac{6901 \times 292 \times 7}{365 \times 200} =$$
$$= £\frac{6901 \times 4 \times 7}{5 \times 200} = £193\ 4s.\ 6{\cdot}72d.\ \text{Ans.}$$

2. If goods purchased at £387 4s. 0d. are sold for £433 6s. 8d., what is the gain per cent. in £ s. d.?

£387 4s. gains £46 2s. 8d.
£1 ,, £46 2s. 8d. / £387 4s.
£100 ,, £46 2s. 8d. × 100 / £387 4s.

$$\therefore £100 \text{ gains } \frac{£46\ 2s.\ 8d. \times 100}{£387\ 4s.} = £11\ 18s.\ 3\tfrac{9}{31}d.$$

3. Bought sugar at £2 5s. 10d. per cwt. Required the selling price per lb. on which 12 per cent. is gained.

1 lb. cost $\frac{550}{112}$d.

100 : 112 :: $\frac{550}{112}$d. : selling price required.

$$\frac{550}{112}\text{d.} \times \frac{112}{100} = 5\tfrac{1}{2}\text{d.}\quad \text{Ans.}$$

4. A house and land were sold for £8,963, and the owner received £8,626 17s. 9d. as the net proceeds of the sale. What was the rate of commission per cent.?

£8963 brings £336 2s. 3d.
£1 ,, £336 2s. 3d. / £8963
£100 ,, £$\frac{336\frac{9}{80} \times 100}{8963}$

$$\text{i.e. } £\frac{2688900}{80 \times 8963} = £\tfrac{30}{8} = 3\tfrac{3}{4}\text{ p. c.}\quad \text{Ans.}$$

FEMALES.

1. Multiply 2½, 3⅜, 10¼, 20⅝, and 5$\frac{9}{23}$, together.

$$\frac{5 \times 27 \times 81 \times 184 \times 124}{2 \times 8 \times 8 \times 9 \times 23} = \frac{37665}{4} = 9416\tfrac{1}{4}.\quad \text{Ans.}$$

2. Simplify the expression:—

$$\frac{1}{13} \text{ of } \frac{1}{1+\frac{1}{3+\frac{1}{4}}}$$

Otherwise $\frac{1}{13}$ of $\frac{1}{1+\frac{4}{13}} = \frac{1}{13}$ of $\frac{13}{17} = \frac{1}{17}$. Ans.

3. Express £$\frac{9}{10}$ − $\frac{3}{8}$ of a guinea as the fraction of half a crown.

£$\frac{9}{10}$ − $\frac{3}{8}$ gui. = 18s. − 17s. 6d. = 6d.
and 6d. = $\frac{1}{5}$ of 2s. 6d. Ans.

4. What is the amount of a bill for ¾ cwt. of sugar at 4½d. a lb., 1½ cwt. of rice at 4$\frac{3}{4}$d. a lb., 70 lbs. of currants at £2 6s. 8d. a cwt., and 25 lbs. of tea, 1½ cwt. of it costing £28 10s. 6d.

				£	s.	d.
¾ cwt. or	84 lbs.	@ 4½d. per lb.	... ...	=	1	11 6
1½ ,, ,,	168 ,,	,, 4$\frac{3}{4}$d. ,,	....	=	3	6 6
	70 ,,	,, £2 6s. 8d. per cwt.	...	=	1	9 2
	25 ,,	,, £25 10s. 6d. for 1½ cwt.		=	4	4 10½
				10	12	0½

Grammar.

1. 'Nor did he *doubt her more*,
But rested in *her* fealty, till he crowned
A happy life with a fair *death*, and fell
Against the *heathen* of the Northern sea
In battle, *fighting for* the blameless king.'—*Tennyson.*

(*a*) Point out the conjunctions in the above, and assign each to its proper class.

(*b*) What are co-ordinate sentences? Show which are the co-ordinate sentences in the above.

(*c*) Parse all the words in italics.

(*a*) *Nor*—(=and not) co-ordinate copulative conj.
but—co-ordinate adversative conj.
till—subordinate temporal conj.
and—simple co-ordinative conj.

(*b*) Co-ordinate sentences are such as are not dependent on one another, or enter into the construction of each other.

The co-ordinate sentences in the above are:—

(1) '(He) rested in her fealty' in adversative co-ordination with (2) 'Nor did he doubt her more,' and (3) 'he crowned a happy life with a fair death' in copulative co-ordination with (4) '(he) fell against the heathen . . . . king.'

(*c*) *Doubt*—trans. verb, reg. infinitive, pres. indef gov. by *did.*
her—pers. pron. 3rd pers. fem. sing. obj. gov. by *doubt.*
more—adv. of time mod. *doubt.*
death—abstr. noun. neut. sing. obj. gov. by *with.*
heathen—collec. noun. neut. sing. obj. gov. by *against.*
fighting—intrans. verb. irreg. *fight, fought, fought, incomplete part.* referring to *he.*
for—prep. relating the 'act of fighting' with *king*, and governing *king* in obj.

2. Point out the verbs in the subjunctive mood in the following sentences, and explain how you know them to be in that mood: 'O that it were with me as in days that are past;' 'Unless he try hard, he will not succeed.'

'were' is in the subjunctive mood because although it appears to be in the past indicative it refers to *present* time, and is therefore past *subjunctive*.

'try' is in the subjunctive because it follows *unless* and indicates both *uncertainty* and *futurity*.

Geography.

Answer *two* questions.

1. Name six important towns, and say fully what you know of each.

See this question answered under 1st year.

2. Draw a full map of British North America.

3. Give full notes of a lesson on 'MALTA.'

POSITION.—Situated in the Mediterranean, 58 miles S. of Sicily, and 179 miles from the N. point of Africa.

EXTENT and CHARACTER.—Little else than mere rock—stretches from N.W. to S.E.—length 18 miles—greatest breadth 10 miles—area about 95 sq. miles—about two-thirds cultivated—most of it made productive by sheer industry—climate excellent, allowing two crops every year—no streams—few springs—rain-water collected in tanks.

TOWN and PEOPLE.—*Valetta*, on N.E. coast (60,000), clean, handsome town, with one of the finest harbours in the world—very strongly fortified—a port of call for vessels to India. *Maltese*, strong and hardy—make excellent seamen—famous for making lace and jewellery—speak an Arabic dialect—are Roman Catholics.

PRODUCTIONS.—No forest trees or hedges—wild thyme in the west feeds bees which produce famed Maltese honey—whole crop of corn lasts inhabitants only three months. *Cotton* is the chief production. Vines and olives are cultivated, figs and oranges abound, and the vegetables are excellent. The asses of Malta are celebrated.

IMPORTANCE.—From its position, commercial and military, it can scarcely be over-valued. Commanding the southern coast of Europe, it is the rendezvous for the British fleet, stationed in the Mediterranean, and along with Gibraltar prevents the closing of the route to our Indian possessions.

HISTORY.—Possessed by the Knights of St. John from 1530; it was taken by the French in 1798, and these again were driven out by the English in 1800, from which time it has remained a British possession.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How came Danish kings to rule over England? Give names and dates of the sovereigns of this line.

The frequent incursions of the Danes forced Ethelred the Unready to buy off the invaders with large sums of money, which was raised by a tax called the *Danegeld*. This cowardly policy led the Danes to come in greater numbers. The two principal leaders were Sweyn and Thurkill. In 1013 Sweyn sailed up the Trent, rapidly conquered the country, and wrested the kingdom from Ethelred. Early the next year Sweyn died. Ethelred was re-called, but died soon after. The war was kept up between his son Edmund and Sweyn's son Canute. Two rival kings were elected 1016, Edmund holding all south of the Thames, along with East Anglia, Essex, and London; Canute took the rest. By the death of Edmund, in the same year, Canute became king of all England, 1017. He was succeeded by Harold I., 1035, who reigned till 1040, and was succeeded by Hardicanute, who reigned till 1042.

2. Compare the dominions of Henry II. with those of Edward the Confessor, and explain the difference.

When Edward the Confessor became king, in 1042, he had only his English kingdom, holding no possessions of his own previous to his election as king. On the other hand Henry II. was a powerful prince before he succeeded to the English crown, in 1154. He was stronger than his feudal lord, the king of France and all his other great vassals put together. *Anjou* and *Maine* he inherited from his father; *Normandy*, from his mother; and *Poitou*, *Aquitaine*, and *Gascoigne* he gained by his marriage with Eleanor. In 1171 he added Ireland to his dominions, his sovereignty being generally acknowledged in that Island.

3. Write down names and dates of the sovereigns who reigned between 1272 and 1399, and show that in this period England was under strong rulers and weak rulers alternately.

Edward I. began to reign 1272. He annexed Wales to England, decided who was to be king of Scotland, and in a great measure conquered that country. The deposition of Baliol, in Scotland, led to a second conquest of that country. Such headway did he make towards the subjugation of the Scots, that he was called the 'hammer of Scotland.' On his death, in 1307, he was succeeded by Edward II., who was already under the power of a favourite—Piers Gaveston—who had been banished by Edward I. The recall of the favourite, and Edward's incapacity, caused the appointment of the *Ordainers*, who lessened the king's power and banished Piers, who, however, returned and was beheaded. His attempt to retake Scotland from Bruce ended in his disastrous defeat at Bannockburn, 1314. Returning from Scotland, he again fell into the hands of favourites, and finally was deposed and secretly murdered, 1327.

The new king, Edward III., put in a claim to the crown of France, 1328. This led to the hundred years' war. In 1346, he gained the famous battle of Crecy, took possession of Calais, which England kept for two hundred years. Ten years afterwards, his brave son gained the battle of Poitiers; and in 1360 he held his possessions in France, not as a vassal, but as an independent sovereign.

His grandson, Richard II., succeeded him in 1377. The beginning of his reign was disturbed by a peasant insurrection, which gave the death-blow to villainage. He was wasteful, dissipated, and frivolously fond of shows and pageants. The Duke of Lancaster, having been banished by Richard, returned while the latter was absent in Ireland, and finding himself more popular than the reigning sovereign, laid claim to the throne. The Lords and Commons deposed Richard on the ground of misgovernment, and he being imprisoned in Pomfret Castle, was found murdered, 1400.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy.*

Composition.

Write full notes of a lesson on 'METALS.'

METALS.

Definition.—Metals form one of the two great classes of mineral substances—all metals being minerals, but all minerals not metallic. (*Show as many specimens of metals as possible, and allow the children to handle them.*) Gold and silver called 'precious'—why? Iron, lead, copper, and zinc, etc., the 'useful'—why?

How found.—Metals found in two common forms—*native*, that is, in the form of pure metal; or as *ore*, that is, mixed up with other substances, from which the metal is extracted by *smelting*. *Gold* found as dust, or *nuggets*, and in quartz—describe the 'diggings.' *Silver*, found mixed with dross, in the form of ore. *Iron* is found in the form of iron-ore, and also mixed with clay and coal. *Lead* is found united with sulphur, its ore is called *galena*. *Zinc* is found in the form of ore. *Copper* is sometimes found native, but generally as an ore. *Tin*, found in the form of *tin-stone*. *Quick-silver*, a fluid metal, becomes hard when frozen.

Manufacture and Uses.—Gold and silver are used for *coins* and *jewellery:* gold, the 'king of metals,' never rusts. Too soft to be used alone; take copper or other metals to harden them. (*Ask for names of various articles made of gold and silver.*)

Iron.—Describe iron furnace with its tower; the mixing of lime, coke, and char, or ore; the melting of the whole, the tapping of the furnace, and the moulding of the molten mass into pig-iron; the process of working it into *wrought-iron;* the changing of wrought-iron into *steel*. (*Ask the children to write down on slates* (1) *large, and* (2) *small articles made of iron or steel.*)

Treat lead, copper, and zinc, etc., in similar way.

Alloys.—Gold, silver, and copper form an alloy; copper alloyed with zinc forms *brass*—with tin forms *bronze* or *bell-metal*, according to certain proportions; lead and tin form *solder;* tin and lead form *pewter;* tin, mixed with antimony and copper forms *Britannia metal.*

Where found.—*Gold* is found principally in Australia and California; *silver*, chiefly in Mexico, Chili, and Peru; *iron*, in Great Britain, Sweden, Belgium, France, and United States;

lead is found in Great Britain and elsewhere; *zinc* is found in Derbyshire and Mendip Hills; *copper*, in Cornwall, Anglesea, and Australia; *tin*, in Cornwall; *quick-silver*, in Spain and South America.

Euclid.

MALES.

[*All generally understood abbreviations for words may be used.*]

1. To describe an equilateral triangle upon a given finite straight line.

What are the *data* and what the *quæsita* in this proposition? What postulates are used in the construction?

See Prop. I., Bk. I.

The *data*, that is, what is given, consists of a straight line, and the *quæsita* or what is sought is the describing of an equilateral triangle upon it.

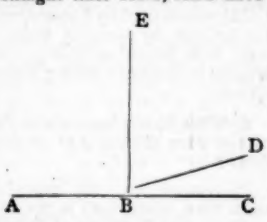
2. To draw a straight line at right angles to a given straight line, from a given point in the same.

See Prop. XI., Bk. I.

3. State and prove the corollary. In what respect is the proof unsound?

3. Corollary to Prop. XI. Bk. I. Two straight lines cannot have a common segment.

If it be possible let the two straight lines ABC, ABD have the segment AB common to both of them.



From the point B draw BE at right angles to AB.

Then because ABC is a straight line, the angle CBE is equal to the angle EBA. Also, because ABD is a straight line, the angle DBE is equal to the angle EBA. Therefore the angle DBE is equal to the angle CBE the less to the greater; which is impossible. Q. E. D.

The above proof is unsound from the fact that we do not know how the perpendicular BE is to be drawn. If we are to use I. 11. we must produce AB, and then we must assume that there is only *one* way of producing AB, for otherwise we shall not know that there is only *one* perpendicular; and thus we have to assume what we have to demonstrate.

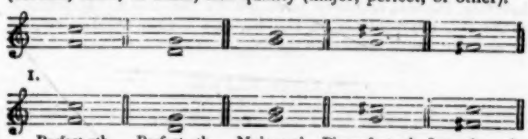
Needlework.

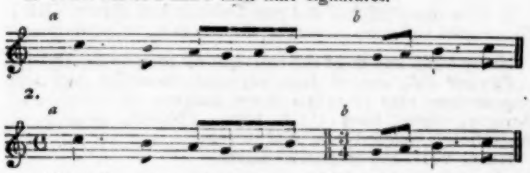
FEMALES.

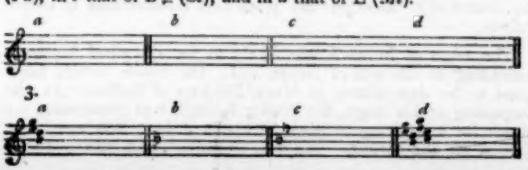
One hour allowed for this Exercise.

Music.

A quarter of an hour allowed for this Paper.

1. Write under each of the following intervals, its name (second, third, or other) and quality (major, perfect, or other).

Perfect 5th. Perfect 4th. Major 3rd. Pluperfect 4th. Imperfect 5th.

2. Place before *a* and *b* their time signatures.

3. Write in *a* the scale signature of D (*Re*), in *b* that of F (*Fa*), in *c* that of B♭ (*Se*), and in *d* that of E (*Mi*).



THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* 1878; **and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. What is the amount of the principal sum from which £270 arises as simple interest in 4½ years, at 6¼ per cent.?

$$\text{Interest of } £100 = £6\tfrac{1}{4} \times 4\tfrac{1}{2} = \frac{25 \times 9}{4 \times 2} = £\tfrac{225}{8}$$

$$\therefore £\tfrac{225}{8} : £270 :: £100 : \text{principal required.}$$

$$\frac{£100 \times 270 \times 8}{225} = £960$$

$$\therefore \text{the amount} = £960 + £270 = \underline{£1230}. \quad \text{Ans.}$$

2. Find the true discount on £107 5s., payable at the end of 6 months, at 3½ per cent.

$$\text{Interest of } £100 \text{ for 6 mo. at } 3\tfrac{1}{2} \text{ p. c.} = \frac{£3\frac{1}{2} \times 6}{12} = £1\tfrac{3}{4}$$

$$\text{Amount of do. for do.} = £101\tfrac{3}{4}$$

$$\therefore \quad £101\tfrac{3}{4} : £1\tfrac{3}{4} :: £107\tfrac{1}{4} : \text{true discount.}$$

$$\frac{£429 \times 7}{4 \times 407} = £\tfrac{1716}{1628} =$$

$$\underline{£1\ 16s.\ 10\tfrac{10}{11}d.} \quad \text{Ans.}$$

3. What is my interest per cent., if for every half-crown invested I receive £·00260416?

$$£\tfrac{1}{2} : £100 :: £·00260416 : \text{interest sought.}$$

$$£·00260416 \times 800 = £2·083 = \underline{£2\ 1s.\ 8d.} \quad \text{Ans.}$$

4. What sum when invested in the 3 per cents. at 98½, will have the nominal value of £14,536, ¼ per cents. brokerage being charged on the amount of the stock?

$$\text{Nominally } £100 \text{ costs } £98\tfrac{1}{2}$$

$$\text{,, } 1 \text{ ,, } £\tfrac{197}{200}$$

$$\therefore \quad \text{,, } £14{,}536 \text{ ,, } \frac{787 \times 14536}{800}$$

$$i.e. \quad \frac{114398·32}{8} = £14299·79$$

$$= \underline{£14299\ 15s.\ 9\tfrac{3}{5}d.}$$

FEMALES.

1. Divide ·2 by ·06 and 6·35 by ·425, each to four places of decimals, and prove the truth of the result by vulgar fractions.

(*a*)

$$\begin{array}{r|l} ·06 & ·20 \\ & \underline{3·3333\ldots} \end{array} \quad \text{Ans.}$$

(*b*)

$$\begin{array}{r|l} ·425 & 6·35 \\ & 425 \\ \hline & 2100 \\ & 1700 \\ \hline & 4000 \\ & 3825 \\ \hline & 1750 \\ & 1700 \\ \hline & 500 \\ & 425 \\ \hline & 750 \\ & 425 \\ \hline & \end{array} \quad \underline{(14·9411\ldots} \quad \text{Ans.}$$

Proof of (*a*) ·2 ÷ ·06 =

$$\frac{2}{10} \div \frac{6}{100} =$$

$$\frac{2}{10} \times \frac{100}{6} =$$

$$\frac{2}{1} \times \frac{10}{6} =$$

$$\frac{2}{1} \times \frac{100000}{60000} =$$

$$\frac{200000}{60000} \times \frac{1}{10000} =$$

Now $\frac{200000}{60000} = 33333\ldots$ from above.

therefore the result $= \frac{33333\ldots}{10000}$

$= 3·3333\ldots$

Proof of (*b*) 6·35 ÷ ·425 =

$$\frac{635}{100} \div \frac{425}{1000} =$$

$$\frac{635}{100} \times \frac{1000}{425} =$$

$$\frac{127}{20} \times \frac{1000}{85} =$$

$$\frac{127}{1} \times \frac{1000}{1700} =$$

$$\frac{127000}{1700} \times \frac{1}{10000} =$$

Now $\frac{127000}{1700} = 149411\ldots$ from above.

therefore the result $= \frac{149411\ldots}{10000}$

$= 14·9411\ldots$

2. Compare the value of ·875 of 10s. 6d. and ·785 of 13s. 4d.

(*a*) $\frac{875}{1000}$ of 10s. 6d. = $\frac{7}{8}$ of 10s. 6d. = 9s. 2½d.
(*b*) $\frac{785}{1000}$ of 13s. 4d. = $\frac{157}{200}$ of 13s. 4d. = 10s. $5\frac{1}{10}$d.

∴ (*b*) is greater than (*a*) by 1s. $2\frac{7}{10}$d. Ans.

3. What number multiplied by $\frac{3}{8}+\frac{5}{6}+\frac{3}{16}-1\frac{1}{2}$ will produce ·37575?

$$\frac{32+30+3}{48}-\frac{24}{16}=\frac{65-56}{48}=\frac{9}{48}$$

Therefore the number required = $\cdot37575\div\frac{9}{48}=$

$$\frac{37575\times48}{90000}=\frac{4175\times48}{10000}=\underline{2\cdot004}.$$ Ans.

4. A man having given $\frac{3}{5}$ of the money in his purse for a sheep, and ·375 of the remainder for a pig, had £1·6875 still left; what sum had he at first?

(*a*) After spending $\frac{3}{5}$ he had $\frac{2}{5}$ of his money left.
(*b*) ·375 = $\frac{3}{8}$; ∴ $\frac{3}{8}$ of $\frac{2}{5}=\frac{3}{20}$ = fraction of money paid for pig.
(*c*) $\frac{3}{5}+\frac{3}{20}=\frac{10+3}{18}=\frac{13}{18}$ = total fraction of money paid away.
(*d*) ∴ £1·6875 = $\frac{5}{18}$ of total sum ∴ total sum = $\frac{£1\cdot6875\times18}{5}$ =

$\frac{£30\cdot375}{5}$ = £6 1s. 6d.

Grammar.

1. 'Hadst thou *but shook* thy head or made a pause
When I spoke darkly *what* I purposed,
Or turned an eye of doubt upon my face,
As bid me tell my tale in express words,
Deep shame had *struck* me *dumb*.'—*Shakespeare.*

(*a*) Point out the subordinate sentences in the above, and assign each to its proper class.
(*b*) Parse the words in italics.
(*a*) The subordinate sentences are:—
1. 'Hadst thou but shook thy head.' (conditional)
2. '(*Hadst thou but*) made a pause.' "
3. 'When I spoke darkly.' (time) "
4. 'What I purposed.' (noun obj. to 3)
5. '(*Hadst thou but*) turned an eye of doubt upon my face.' (conditional)
6. 'As (*if thou wouldst*) bid me tell my tale in express words.' (manner with purpose)

(*b*) *but*—(only) adv. deg., mod. *shook*.
shook—(shaken) trans. verb, irreg. *shake, shook, shaken*, complete part., referring to *thou*, forming past perf. indic. with *hadst*.
what—rel. pron. 3rd pers. sing. neut., containing both antecedent and rel. obj. gov. by *spoke* and *purposed*.
As—subordinating conj., introducing an adverbial sent.
bid—trans. verb. irreg. *bid, bade, bidden*, infin. pres. gov. by (*wouldst*).
me—pers. pron. 1st pers. sing. com. obj. gov. by *bid*.
tell—trans. verb. irreg. *tell, told, told*, infin. pres. gov. by *bid*.
struck—trans. verb irreg. *strike, struck, struck*, complete part. referring to *shame*, forming past perf. subj. with *had*.
dumb—adj. used predicatively, qual. *me*.

2. '*And now, their mightiest quelled, the battle swerved.*' Point out the nominative absolute in this phrase, and show how a nominative absolute differs from a noun in apposition.

The nominative absolute is '*their mightiest quelled.*' A nominative absolute differs from a noun in apposition, (which is always an attributive adjunct to the noun) in being used as an adverbial adjunct to the predicate. *e.g.*:—
The sun having risen (absol. phrase), we set out.
Brown, *the draper* (noun in appos.), is bankrupt.

3. The Latin prepositions which enter into the composition of the words '*collide*' and '*support*,' are cum and sub; give the meaning of each preposition, and the rule which regulates the changes made in the spelling of prepositions in some compounded words.

Cum means *with, together with.*
Sub " *under.*

The rule which regulates the changes made in the spelling of prepositions in some compounded words is *Letters that cannot be easily sounded together are assimilated, e.g.*—*ad*firm becomes *af*firm; *ad*rogate, *ar*rogate; *con*-lide, *col*-lide; *sub*-port, *sup*-port; *sym*pathy, *sym*pathy.

Geography.

1. Give full notes of a lesson on 'The Journey to India by the Suez Canal.'

Illustrate by a map or maps.

I. *Routes to Alexandria.*—(*a*) London to Southampton—steam to Alexandria, calling at Gibraltar and Malta. (*b*) London to Dover—steam to Calais by rail to Marseilles, steam to Alexandria, calling at Malta. (*c*) London to Calais, by rail through France and Italy to Brindisi—steam to Alexandria.
II.—*Alexandria to India.*—Steam down the Suez Canal to Aden, and thence across the Indian Ocean to Bombay, Ceylon, Madras, or Calcutta.
III.—*Notes on the Journey. Gibraltar*, fortified rock belonging to Britain—'Key to the Mediterranean'; this rock and the one opposite on the Coast of Africa, called by the ancients the 'Pillars of Hercules.' *Malta*, belonging to Britain, chief town, Valetta, strongly fortified, sometimes called the 'Diamond of the Mediterranean.' *Alexandria*, chief port of Egypt. Suez Canal, constructed by Lesseps, connects the Mediterranean with the Red Sea, by means of which there is a continuous 'waterway' from Britain to India. *Aden*, a fortress of Arabia, belonging to Britain, a coaling place for steamers, and a telegraph station.

2. What do you know about *Pietermaritzburg, Plassy, Pondicherry, Port Natal, The Pruth, The Punjab*, and *Rupert's Land*?

Pietermaritzburg, the capital of the Colony of Natal, is a small town, neatly built in the form of a parallelogram.
Plassy, 83 miles north of Calcutta, in the Presidency of Bengal, is memorable for the decisive victory gained by Clive, 1757, which established British supremacy in India.
Pondicherry, the capital of the French possessions in India, is a very handsome maritime town.
Port Natal is an inlet on the coast of Natal, South Africa; D'Urban, the port of the Colony of Natal, is on its north shore.
The Pruth is a river which rises in the Carpathian Mountains, forms the boundary between Roumania and Russia, and falls into the Danube below the town of Galatz.
The Punjab—meaning the 'five rivers'—is an extensive province of British India, embracing the country watered by the Indus and its five great tributaries—the Jhelum, Chenab, Ravee, Beas, and Sutlej. It was annexed to the British possessions after the battle of Goojerat, 1849.
Rupert's Land is named from Prince Rupert, who was one of the founders of the Hudson Bay Company. It is now for the most part included in the north-west territories of British North America, but was formerly bounded by the Rocky Mountains on the W., Hudson Bay on the E., the United States on the S., and the Arctic Ocean on the N.

SECOND PAPER.

Two hours and a half allowed.

History.

1. How many children and grandchildren had Henry VIII.? Give names and dates of such of them as came to the throne.

Henry VIII. had three children, who all came to the throne.
Edward VI., son of Jane Seymour, succeeded him and reigned from 1547 to 1553. *Mary*, daughter of Catherine of Arragon, reigned from 1553 to 1558. *Elizabeth*, daughter of Anne Boleyn, reigned from 1558 to 1603.
Henry VIII. had no grandchildren.

2. Why were the reigns of James I. and George I. likely to be disturbed? Mention any plots and insurrections in those reigns.

The reign of James I. was likely to be disturbed because, according to the will of Henry VIII., the crown should have gone to the descendants of Mary, Duchess of Suffolk. In the beginning of his reign, Sir Walter Raleigh was condemned to death for conspiring to place Arabella Stuart, first cousin of James, on the throne. He was reprieved, and Arabella un-

molested, until she married William Seymour, a descendant of the Duchess of Suffolk. This union so alarmed James that he shut Arabella up in the Tower, where she died. This plot of Raleigh's was called the Main-plot. There was another called the Bye-plot, said to be a design for seizing the king, and making changes in the government.

By showing his real feelings towards the three religious parties, the Roman Catholics were dismayed, and a few fanatics of their number got up the famous Gunpowder Plot, 1605.

George I. being a foreigner, and caring more for Hanover than for England, could never become popular; and besides, his claim was disputed. James the Pretender having put forward his claims on the death of Anne found many sympathizers, especially in Scotland. An invasion of England was planned, and the Earl of Mar's rebellion, or the rebellion of 1715, took place. Simultaneously a defeat was sustained by the Jacobites at Sheriffmuir in Scotland, and Preston in England. These disasters prevented the Jacobites from making further attempts for thirty years.

3. What do you understand by Repeal of the Union? Show that separation would be injurious to all parts of the United Kingdom.

By the Repeal of the Union is meant the cancelling of the legislative union between Britain and Ireland. Before this union, Ireland possessed a Parliament of her own, and though subject to the king was practically independent of Great Britain.

It would be injurious to Ireland, by causing a heavier taxation among a poor people, in a limitation of the free-trading that she now enjoys in common with the other parts of the United Kingdom, and from the protection which an Irish Parliament would almost be sure to make against every British manufacture. As regards the injury to the other parts of the United Kingdom, Ireland would soon be a base for enemies to carry out their designs against the British Sovereign; and in a short time Ireland would in all likelihood become the property of any foreign state strong enough and willing enough to fall in with the wishes of her demagogues. It would be very dangerous to the peace of Britain to have such a hot-bed of unreasonable, revengeful, and treacherous enemies so near her shores. These are but a few of the reasons why Britain should keep a firm hold on this beautiful but unfortunate Island.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy.*

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

Euclid.

MALES.

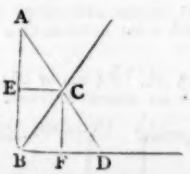
[All generally understood abbreviations for *words* may be used.]

1. If a straight line, falling upon two other straight lines, make the exterior angle equal to the interior and opposite upon the same side of the line; or make the interior angles upon the same side together equal to two right angles; the two straight lines shall be parallel to one another.

See Prop. 28, Bk. I.

2. From a given point without the angle contained by two given lines, draw a line so that the part of it between the given point and the nearer line may be equal to the part between the two given lines.

(Given A, BC, BD; bisect AB at E, draw EC ∥ BD; ACD is the line required.)



The figure being drawn according to the given construction, through C draw CF parallel to BE. Then BECF is a parallelogram and ∴ FC = BE = EA. Again the angle FCD = angle BAC, and the angle ECA = angle FDC. (1. 29.) Wherefore in the two triangles FCD, ECA, there are two angles in the one equal to two angles in the other, and the side FC = the side EA, therefore (1. 26) the two triangles are equal in every respect, and AC = CD. Q.E.F.

3. To describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

See Prop. 42, Bk. I.

Algebra.

MALES.

(Pupil teachers are expected to show that they have learnt the *proofs* of the rules.)

1. *Prove the rule* for subtracting algebraical quantities.
From $(x+y)(a+b+c)$ take $(a+b-c)(x+y)$.

1. Suppose we have to take $b+c$ from a. Then, as each of the numbers b and c is to be taken from a, the result is shown by $a-b-c$. That is $a-(b+c)=a-b-c$. Next, suppose we have to take $b-c$ from a. If we take b from a we obtain $a-b$; but we have taken too much from a, for we were required to take not b but $b-c$, that is b diminished by c. Hence we must increase the result by c; thus:—

$$a-(b-c)=a-b+c.$$

From the consideration of these cases we arrive at the following rule:—*Change the signs of all the terms in the expression to be subtracted and then add it to the other expression.*

$(x+y)(a+b+c)=ax+bx\times cx+ay+by-cy.$

$(a+b-c)(x+y)=ax+bx-cx+ay+by-cy.$

$2cx \qquad +2cy=\underline{2c(x+y)}.$ Ans.

2. *Prove the rule* for dividing a fraction by an integer.

Simplify $\dfrac{a-3x}{3a+x}+2\frac{1}{3}-\dfrac{3a-x}{a+3x}$

2. To divide a fraction by an integer we may either (1) *multiply the denominator*, or (2) *divide the numerator by it.*

(1) $\dfrac{a}{b}\div n=\dfrac{a}{bn}$; for in the fraction $\frac{a}{b}$ the unit is divided into b equal parts, a of which parts are taken; whereas in the fraction $\frac{a}{bn}$ the unit is divided into bn equal parts of which a parts are taken; now since each part of the latter fraction is $\frac{1}{n}$th of each part of the former, it follows that $\frac{a}{bn}$ is $\frac{1}{n}$th part of $\frac{a}{b}$, hence $\frac{a}{b}\div n=\frac{a}{nb}$;

(2) $\dfrac{bn}{a}\div n=\dfrac{bn}{an}=\dfrac{b}{a}$.

$\dfrac{a-3x}{3a+x}+\frac{2}{3}-\dfrac{3a-x}{a+3x}$

L. C. M. of denrs. $=3(3a+x)(a+3x)$

$\dfrac{3(a-3x)(a+3x)+8(3a+x)(a+3x)-3(3a-x)(3a+x)}{3(3a+x)(a+3x)}=$

$\dfrac{3a^2-27x^2-27a^2+3x^2+24a^2+80ax+24x^2}{3(3a+x)(a+3x)}=$

$\underline{\dfrac{80ax}{3(3a+x)(a+3x)}}$ Ans.

3. Solve the equation $\dfrac{3x+4}{14}-\dfrac{2x-7}{21}+2\frac{1}{4}=\dfrac{x-4}{4}$

Clearing of fractions—

$18x+24-8x+28+231=21x-84$

$18x-8x-21x=-84-231-28-24$

$\underline{11x=-33\frac{1}{11}x}$. Ans.

Needlework.

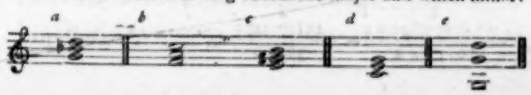
FEMALES.

One hour allowed for this Exercise.

Music.

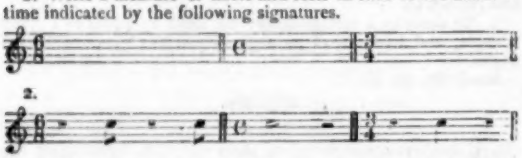
A quarter of an hour allowed for this Paper.

1. Which of the following chords are major and which minor?

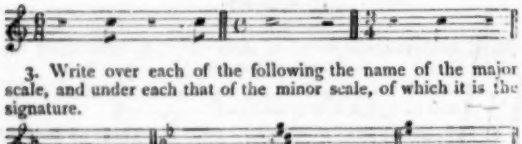


1.

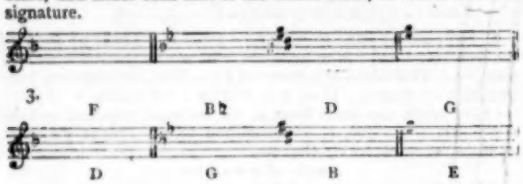
2. Write a measure of notes and rests in each of the kinds of time indicated by the following signatures.



2.



3. Write over each of the following the name of the major scale, and under each that of the minor scale, of which it is the signature.



3.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st *May*, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. I am required to invest in 3½ per cents. standing at 93½ a sum sufficient to provide for the payment of the rent of a house let to me at £57 15s. a quarter. What sum must I invest, brokerage ¼ per cent.?

Rent is equivalent to £231 per annum.

£3½ is got from £93½

1 „ „ £$\frac{93\frac{1}{2}}{3\frac{1}{2}}$

£231 „ „ £$\frac{373 \times 231}{14}$.

i.e. £$\frac{373 \times 33}{2}$ = £$12\frac{1}{2}09$

i.e. £6154 10s. Ans.

2 Receiving £·56875 per week of 6 days and spending 66·6 per cent. of his wages, how many days more or less than a year of 52 weeks will a boy take to save £10?

(*a*) By spending 66·6 p.c. he saves 33⅓ p.c., or ⅓ of the whole.

(*b*) ∴ daily he saves £$\frac{\cdot 56875}{6 \times 3}$ = $\frac{136\cdot 5}{18}$d. = $7\frac{7}{12}$d.

(*c*) Hence No. of days required to save £10 = $\frac{2400}{7\frac{7}{12}}$ = $\frac{28800}{91}$

= $316\frac{4}{91}$ days.

i.e. $44\frac{4}{91}$ days more than a year of 52 weeks of 6 days each.

3. If the interest on £362 15s. for a given time at 3 per cent. be £10 17s. 7·8d., at what interest per cent. will double that principal amount to £785 7s. 11·7825d. in the same time?

(*a*) Interest on two times £362 15s. = (£785 7s. 11·7825d. − £725 10s.) = £59 17s. 11·7825d.

(*b*) £10 17s. 7·8d. : £59 17s. 11·7825d.
or
2611·8d. : 14375·7825d. } :: 3 : rate required.
2 : 1

£? = $\frac{14375 \cdot 7825 \times 1}{2611 \cdot 8 \times 2}$ = £$\frac{43127 \cdot 3475}{5223 \cdot 6}$ = £$\frac{431273475}{52236000}$ = £$8\frac{41}{176}$ p.c.

4. Find, and state in decimal form, the *average* of the following 5 quantities:—

$\frac{11}{\frac{1}{2}}$ of ½, ·018, 0, 3, and $\sqrt{2\frac{7}{9}}$.

$\frac{11}{\frac{1}{2}}$ of ½ = $\frac{22}{62}$ = ·353535

·018018

0

3·

$\sqrt{2\frac{7}{9}}$ = $\sqrt{\frac{25}{9}}$ = $\frac{5}{3}$ = 1·666666

5 | 5·038220

1·007044. Ans.

NOTE.—Divide the sum of the quantities by the number of them.

5. What are logarithms, and what is the use of them? Give examples.

Logarithms may be considered as the exponents in any numerical expression.

Thus $a^x = b$. Here x is the logarithm of b to the base a, or it expresses that power to which the base must be raised to give the number.

By means of logarithms we can substitute addition and subtraction in long and involved computations for multiplication and division.

For example, in Briggs' system, every number or fraction of a number is either a power of ten, positive or negative, or lies between two powers of ten. The powers of ten are as follows:—
$10^0 = 1$; $10^1 = 10$; $10^2 = 100$; $10^3 = 1000$; $10^4 = 10000$;.....
$10^{-1} = \cdot 1$; $10^{-2} = \cdot 01$; $10^{-3} = \cdot 001$; $10^{-4} = \cdot 0001$.....

Hence the log. of 1 is 0; log. ·1 is −1
„ 10 „ 1; „ ·01 „ −2
„ 100 „ 2; „ ·001 „ −3
„ 1000 „ 3; „ ·0001 „ −4
....

10 × 100 = log. 10 + log. 100 = 1 + 2 = 3 = log. 1000.
1000 ÷ 10 = log. 1000 − log. 10 = 3 − 1 = 2 = log. 100.

FEMALES.

1. Find the amount of 1895 guineas for 4¾ years at 2¾ per cent.

Interest = 1895 gui. × 4¾ × $\frac{2\frac{3}{4}}{100}$ = £$\frac{1989\ 15s. \times 19 \times 11}{4 \times 400}$ =

£$\frac{415857\ 15s.}{16 \times 100}$ = £259 18s. $2\frac{5}{8}$d.

∴ Amount = (£1989 15s. + £259 18s. $2\frac{5}{8}$d.) = £2249 13s. $2\frac{5}{8}$d. Ans.

2. Find by Practice, the cost of 4685½ lbs. of butter at 1s. 7½d. a lb., and the cost of 39 oz. 16 dwts. 18 grs. of silver at 9s. 10d. per oz.

		£	s.	d.
(*a*) Value of 4685½ lbs. at £1 each =		4685	10	0
„ „ „ 1s. „ = $\frac{1}{20}$ of val. at £1 =		234	5	6
„ „ „ 6d. „ = ½ „ 1s. =		117	2	9
„ „ „ 1½d. „ = ¼ „ 6d. =		29	5	$8\frac{1}{4}$
„ „ „ ¾d. „ = ⅛ „ 1½d. =		7	6	$5\frac{1}{8}$
„ 4685½ lbs. at £0 1s. 7½d. each =		£388	0	$4\frac{1}{8}$
		£	s.	d.
(*b*) Val. of 1 oz.		= 0	9	10
				39
„ 39 oz.	=	19	3	6
„ 10 dwts. cost ¼ value of 1 oz.	=	0	4	11
„ 5 „ „ ½ „ 10 dwt.	=	0	2	$5\frac{1}{2}$
„ 1 „ „ ⅕ „ 5 „	=	0	0	$5\frac{1}{10}$
„ 12 grs. „ ¼ „ 1 „	=	0	0	$2\frac{1}{20}$
„ 6 „ „ ½ „ 12 grs.	=	0	0	$1\frac{1}{40}$
„ 39 oz. 16 dwts. 18 grs.	=	£19	11	$8\frac{3}{4}$

3. If a snail crawl on the average 5½ in. in 5 min. 3 sec., what fraction, and also what decimal of a mile, would it crawl in 2·4 hours?

5 min. 3 sec. or 303 sec. : 2·4 ho. or 8640 min. :: 5½ in. : ? $\frac{11}{2}$ in. × $\frac{8640}{303}$ = $\frac{1584}{101}$ in. which reduced to the fraction of a mile = $\frac{1584}{101 \times 63360}$ = $\frac{1}{4031}$. Decimally ·0002475

Grammar.

1. '*Whoever* wishes to be well acquainted with the morbid anatomy of governments, whoever wishes to know *how* great states *may be made feeble* and wretched, should *study* the history of Spain. The empire of Philip the *second* was undoubtedly *one* of the most powerful and splendid *that* the world ever saw. If we overlook a *hundred* years, and then look at Spain, *what* a *change* do we *find?*'—MACAULAY.

(*a*) Pick out from the above a noun sentence, an adjective sentence, and an adverbial sentence; and analyse the adjective sentence.

(*b*) Parse the words in italics.

(*a*) Noun Sentence—'How great states may be made feeble and wretched,' object of *to know*.

Adjective Sentence—'That the world ever saw,' qualifying *empires*.

Adverbial Sentence—'If we overlook a hundred years,' modifying *do find*.

Analysis of Adjective Sentence.

the world ..... subject.
saw ..... predicate.
that ..... object.
ever ..... extension (of time).

(*b*) *Whoever*—comp. rel. pron. containing antecedent and rel. *he* nom. to *should study* and *who*, 3rd pers. sing. masc. nom. to *wishes*.

how—subord. conj. adv. of manner, introducing, noun. sent. and mod. *may be made*.

may—defect. verb, *may, might*, indic. pres. indef. 3rd pers. plu. agr. with subj. *states*.

be—subst. verb, irreg. *am was been*, infin. pres. indef. governed by *may*.

made—trans. verb, irreg. *make made made*, complete participle, referring to *states*.

may be made—might be parsed according to some grammarians as pres. pct. passive voice.

feeble—adj. predicative of states.

study—trans. verb, reg. infin. pres. indef. gov. by *should*, and forming with it the past pot.

second—adj. predicative of *Philip*.

one—pron. indef. 3rd pers. sing. neut. referring to *empire*, nom. after *was*.

that—rel. pron. 3rd pers. plu. neut. referring to (empires) obj. by *saw*.

hundred—num. adj numbering *years*.

what—adj. qual. *change*.

change—abst. noun, neut. sing. obj. governed by *find*.

find—trans. verb, irreg. *find, found, found*, infin. pres. indef. governed by *do*, and forming with it, emphatic form of pres. indic. active.

2. Many of our words denoting offices and degrees of rank, and many referring to the Church, are of Latin or Norman-French origin; account for this, and give examples of words in illustration.

The Romans occupied Britain for about four hundred years, and the Latin introduced by the Romans themselves is called *Latin of the First Period*. The Latin brought in through intercourse with the Church of Rome, about the time of St. Augustine, is called the *Latin of the Second Period*. The Latin that came to us through the Normans in the corrupt form of Norman French, is called *Latin of the Third Period*. The following are examples of offices and degrees of rank:—*Canon, chancellor, constable, count, duke, squerry, lieutenant, marquis, mayor, prince, viscount*. Words referring to the Church:—*mass, preach, saint, chapter, creed, chalice*, belong to the First Period. *Baptism, Bible, ceremony, charity, friar, sacrifice, penance, tonsure*, belong to the Third Period.

Geography.

1. Draw a map of that part of the Atlantic Ocean which lies between lat. 40° N. and lat. 40° S.

See a good Atlas.

2. Give notes of a lesson to an advanced class on 'A Voyage from the Straits of Magellan to St. John's, Newfoundland,' with special attention to the river-mouths that are passed, the currents of the ocean, the prevailing winds, and the changes of climate.

RIVER-MOUTHS.—Negro, Colorado, La Plata, formed by the Parana and Uruguay, in La Plata; Grande, San Francisco, Paranhyba, Maranhao, and Amazon, in Brazil; Surinam, Berbice, Demerara, Essequibo, in Guiana; Orinoco, in Venezuela; Magdalena, in New Grenada.

San Juan, in Central America; Grande del Norte, in Mexico; Colorado, Mississippi, Mobile, Savannah, Roanoke, James, Potomac, Susquehanna, Delaware, Hudson, in United States; St. John, in New Brunswick; St. Lawrence, in Canada.

CURRENTS.—Leaving the *Cape Horn* current, we enter the *Brazil* current, which skirts the western edge of the *South Atlantic* current; pass into the *Equatorial Stream*, then into the *Gulf Stream*, which carries us to Newfoundland.

WINDS.—*Trade Winds* extend to 28° on each side of the Equator—divided by a tract of sea usually occupying a width of from 6° to 8° of latitude—this belt, called the *Region of Calms* and *Variable Winds;* Region of the *North-east* Trade Winds, north of the Equator; Region of the *South-east*, south of the Equator; north-east Trade wind blows with less steadiness than the south-east, but towards West India Islands it keeps generally steady between east and north-east.

CLIMATE.—Leaving the border of the *South Frigid Zone* we pass through the *Temperate Zone*, into a belt where the temperature is 68° Fahr. all the year round; into the *Torrid Zone;* thence again into a belt with an average temperature of 68° for whole year, and enter the *North Temperate Zone*, and at Newfoundland we are in the region where the temperature is 32° for the year.

Note.—With the pupils before a map of the Atlantic, a graphic account of the voyage may be given, showing what currents may be taken advantage of and which avoided, how to have the aid of the Trade Winds; picturing out 'crossing the Line,' and 'lying becalmed.'

SECOND PAPER.

Two hours and a half allowed.

History.

1. 'William Rufus, Henry I., Stephen, John, Henry IV., Henry V., Henry VI., Richard III., and Henry VII., all reigned in defiance of the strict rules of descent.' Show briefly the truth of this statement.

1. William Rufus was not the eldest son of the Conqueror, yet he succeeded to the throne and kept out his eldest brother Robert, Duke of Normandy.

Henry I., who succeeded Rufus, seized the throne, which ought to have gone to his eldest brother Robert.

Stephen succeeded Henry I., but Matilda, Henry's daughter, was the rightful heir.

John succeeded his brother Richard I., though Arthur, son of his elder brother Geoffrey, was the proper heir.

When Henry IV. ousted Richard II., his cousin, Edmund Mortimer, great-grandson of Lionel, Duke of Clarence, was the rightful heir.

Henry V. took the throne, although that same Edmund Mortimer was living.

Henry VI. was descended from the *third* son of Edward III., while the Duke of York, who contended for the crown, was descended from the *second*.

Richard III. usurped the throne which ought to have belonged to Henry, Duke of Richmond, the last male descendant of the House of Lancaster.

Henry VII. had not such a strong right to the throne as Elizabeth of York or Edward, Earl of Warwick, son of the Duke of Clarence, another representative of that House.

2. Napoleon I. wrote in 1807 to his brother, then King of Holland, 'you have none but nobles about you; the opinion of these persons is always in direct contradiction to that of the public.' Quote some conspicuous examples from our history to invalidate this assertion.

Godwin, during the reign of Edward the Confessor.
Lanfranc, in the reign of William the Conqueror.
Anselm, Archbishop of Canterbury, in the reign of Rufus.
Stephen Langton, Archbishop of Canterbury, in the reign of John.
The *Earl of Pembroke* and *Simon de Montfort*, under Henry III.
The *Earls of Warwick* and *Lancaster*, under Edward II.
The *Dukes of Bedford* and *Gloucester*, under Henry VI.
Lord Clarendon, under Charles II.
William Pitt, Earl of Chatham, under George III.

3. At what periods since the Conquest was this country likely to have kings named Arthur, Eustace, Frederick, Henry IX.?

In 1199, Arthur of Brittany should have been king instead of John, his uncle.

Had Eustace lived, he very possibly might have succeeded his father Stephen in 1154.

Frederick, son of George II., would have come to the throne in 1760 had he not died nine years before his father.

Had James II. and his descendants not been disinherited, his grandson Henry, Cardinal of York, might have succeeded his brother Charles Edward, who died 1788.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Apostrophy*.

Write, in small hand, as a specimen of copy-setting, *Petrarch, the troubadour of Italy*.

Composition.

Write a short essay on *The Post Office*.

Previous to the seventeenth century there is nothing heard of a Post Office. From the state of society only the business of State demanded correspondence. The most complete step taken in the establishment of a Post Office was in 1657, when an Act was passed to settle the postage between England, Scotland, and Ireland. This has been the model of all subsequent measures on the subject. Up to 1838 a great many Acts of Parliament were passed. At that date the Rev. Rowland Hill began to mature those plans which were to revolutionize the postal system. He proposed the daring suggestion that all the existing rates of postage should be abolished, and their place taken by a uniform rate of *one penny*, regardless of distance, the carriage of the letter to be *prepaid* by means of *stamps*. This plan was condemned among the upper classes, but the country at once warmly approved of it, and at length it was adopted by Parliament. The example of England was gradually followed by every civilized State.

About twelve years ago some of the most important latest changes were made. The halfpenny postal-card was introduced, and reductions in the charge for books, patterns, etc., were made. About the same time foreign postage was reduced. Now, connected with the Post Office, we have Money-orders, Life Annuities, Insurance, a Dead-Letter office, and the Telegraphs. Under the present Postmaster-General various convenient reforms have been and are likely to be made.

The transmission of mails in this country, as regards regularity and safety, will compare favourably with that of any nation in the world, and although not in all respects perfect, it approaches to that standard more closely than any similar establishment.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If a straight line be divided into any two parts, the squares on the whole line, and on one of the parts, are equal to twice the rectangle contained by the whole and that part, together with the square on the other part.

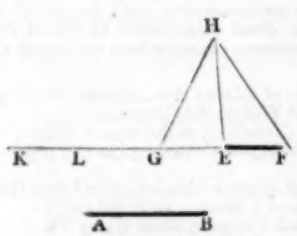
Produce a given line so that the rectangle of the whole line produced, and the original line shall be equal to a given square.

(*a*) See Prop. 7, Bk. II.

(*b*) Let EF be the given line (obviously less than AB the side of the given square.)

From E draw EH perpendicular to EF and equal to AB the side of the square.

Join HF, and at the point H in HF make the angle FHG= the angle GFH, then GH=GF (I. 6.)



Produce FG to K, making GK=GF or GH. Now, because KF is divided equally in G and unequally in E, the rectangle KE·EF + square on GE= square on KG (II. 5), or square on GH. But the square on GH= squares on GE and EH. ∴ the rectangle KE·EF + square on GE= the squares on GE and EH.

Take away the common square on GE and the rectangle KE·EF= square on EH, which is equal to the side of the given square. ∴ If from FK a part FL be cut off equal to KE, then FE shall have been produced so that the rectangle LF·FE is equal to a given square, namely, the square on AB.

2. To describe a square that shall be equal to a given rectilineal figure.

See Prop. 14, Bk. II.

Algebra.

MALES.

(Pupil Teachers are expected to show that they have learnt the *proofs* of the rules.)

1. *Prove* that $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$, the letters representing any numbers.

Reduce $\frac{27x^3 - 57x - 14}{39x^3 - 64x - 63}$ to lowest terms.

1. (*a*) Let $\frac{a}{b} = x$ and $\frac{c}{d} = y$ then $a = bx$, and $c = dy$

$$\therefore ac = bdxy;$$

hence dividing each of these equals by bd,

$$\frac{ac}{bd} = xy$$

but $xy = \frac{a}{b} \times \frac{c}{d} \therefore \frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$. Q.E.D.

(*b*) $$\frac{27x^3 - 57x - 14}{39x^3 - 64x - 63} = \frac{(9x + 2)(3x - 7)}{(13x + 9)(3x - 7)} = \text{in lowest terms } \frac{9x + 2}{13x + 9}$$

2. *Prove* that in any equation any quantity may be transferred from one side to the other without affecting the result, the sign of the quantity so transferred being changed.

Solve (1.) $13x - y = 1 = x - 31y$.

(2.) $132x^2 = 1 - x$.

2. This is proved by means of the axiom or self-evident proposition, that '*if equal quantities be added to or subtracted from equal quantities the sums or remainders will be equal.*'

Let $x + a = b$

subtract a from each side of the equation. Then

$$x + a - a = b - a$$

but $a - a = o$

$$\therefore x = b - a$$

Where a is on the right side, with sign changed.

Again, let $x - a = b$

Add a to each side of the equation. Then

$$x - a + a = b + a$$

or $x = b + a$

Where a has changed its side and its sign.

(1) $13x - y = 1$ or $13x - y = 1$ or $403x - 31y = 31$

$x - 31y = 1$ „ $13x - 403y = 13$ „ $x - 31y = 1$

by subtracting $\therefore 402y = -12$ and $402x = 30$

$y = -\frac{6}{201}$ $x = \frac{15}{201}$

(2) $$132x^2 = 1 - x$$

$$132x^2 + x - 1 = o$$

breaking up left side of equation

$$(12x - 1)(11x + 1) = o$$

hence $12x = 1$

$$\therefore x = \tfrac{1}{12}$$

or $11x = -1$

$$\therefore x = -\tfrac{1}{11}$$

i.e., $x = \frac{1}{12}$ or $\frac{1}{11}$. Ans.

3. A man started on an errand at the rate of $3\frac{3}{4}$ miles an hour, and half an hour afterwards another was sent to overtake him, which he did in 2 hours; what was his rate?

Let x miles = rate of the second per hour.

then $2x = 3\frac{3}{4}$ mls. $\times 2\frac{1}{2} = \frac{45}{8}$

$$12x = 55$$

$x = 4\frac{7}{12}$ miles per ho. Ans.

Mensuration.

MALES.

The rent of a four-sided field is £31 4s., at £3 4s. per acre, and the sum of the perpendiculars on the diagonal is 143 yards; what fraction of a mile is the diagonal?

Area of field = £31 4s. ÷ £3 4s. = $\frac{39}{4}$ = 9·75 ac.

Now the diagonal multiplied by the sum of the perpendiculars gives two times the area.

∴ diag. × 143 yds. = 9·75 × 2 = 19·50 ac.

diag. $= \frac{19{\cdot}5 \text{ pc.}}{143 \text{ yds.}} = \frac{195 \times 4840}{1430}$ yds. $= 15 \times 44 = 660$ yds.
and 660 lineal yds. $= \frac{660}{1760}$ ml. $= \frac{3}{8}$ mls. Ans.

Needlework.

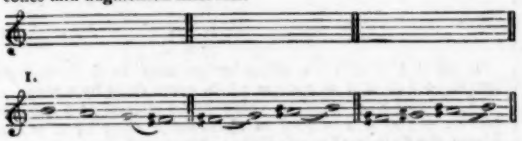
FEMALES.

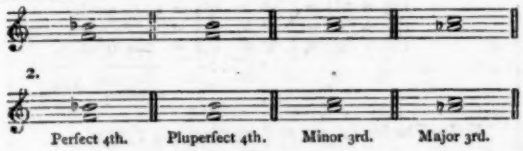
One hour allowed for this Exercise.

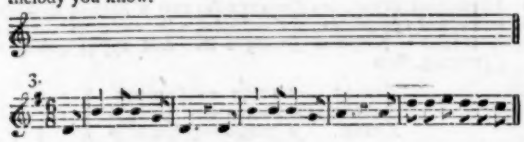
Music.

A quarter of an hour allowed for this Paper.

1. Write the upper tetrachord of B (Si) minor in every form with which you are acquainted. Mark the places of the semitones and augmented intervals.



2. Write, under each of the following pairs of notes, the name and quality (major, perfect, diminished, or other) of the interval it forms.

Perfect 4th. Pluperfect 4th. Minor 3rd. Major 3rd.

3. Write, from memory, the first four or more measures of any melody you know.

Publications Received.

Botany—
(1) Twining's Lectures on Plants. W. Poole.
Classics—
(1) Bell's Cambridge Texts. Geo. Bell and Son.
Geography—
(1) Map Drawing Books. Philip & Son.
(2) British School Atlas. Gall & Inglis.
(3) Shilling National Atlas and Sixpenny. W. & A. K. Johnston.
(4) Maps. W. & A. K. Johnston.
Geometry—
(1) Hulme's Plain Geometrical Drawing. Longmans.
History—
(1) Johns' History of England. Crosby Lockwood & Co
(2) Tables of English History. T. Laurie.
Miscellaneous—
(1) Pascoe's Everyday Life in our Public Schools. Griffith & Farran.
(2) Spencer's Bicycle Road Book. Griffith & Farran.
(3) Lamb's Tales from Shakspere. Whittaker & Co.
(4) Dictionary of Mythology. Whittaker & Co.
(5) Plutarch's Lives. Whittaker & Co.
(6) Handy Classical Dictionary. Whittaker & Co.
(7) Hossfeld's Methods of Learning Foreign Languages. W. Poole.
(8) History of Shorthand. W. H. Allen & Co.
Music—
(1) Burlington Song Book. R J. Derfel.
Periodical Literature—
(1) Ward & Lock's Universal Instructor, XVIII. Ward, Lock & Co.
(2) Book of Sports. Cassell & Co.
(3) The Monograph. Q. P. Index.
(4) Oxford Examiner, III. Thos. Laurie.
(5) Our Little Ones, VI. Griffith & Farran.
Reading Books—
(1) Blackie's Graded Readers. Blackie & Son.
Scripture—
(1) Abraham's Manual of Scripture History. Trübner & Co.
(2) Scripture Manuals—St. John. T. Murby.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

EXERCISE IV.

(1) $32b$. (2) $-48bc$. (3) $1002xyz$. (4) $68abc$. (5) $-112xyz$. (6) $1366mp$. (7) $13a+13b-21c$. (8) $11a+25b-12c$. (9) $27x-23y+12z$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

(No. 3.)

STANDARD III.

A. 1. 16,980—3.
2. 22,263—23.
3. 6923—606.
B. 1. 1084—78.
2. 16,628—62.
3. 404—715.
C. 1. 25,165,824.
2. £3906 12s. 6½d.
3. £66,259 12s. 4d.
D. 1. £30 2s.
2. 130—21,210.
3. £11 15s. 1½d.
E. 1. £939 5s. 8½d.
2. 770,574.
3. £128 7s. 3d.
F. 1. 412—55,560.
2. £54,166 13s. 4d.
3. £31 2s. 6d. gain.

ADVANCED EXAMINATION.

1. £1 16s. 8d. gain.
2. £6,930,993 19s. 9¾d.
3. £17 2s. 9d.

STANDARD IV.

A. 1. £10,942 5s.
2. £49.757 4s. 0½d.
3. £5120 2s. 3¾d.—5.
B. 1. £2901 18s. 0¾d.
2. £61 13s. 7½d.—29.
3. 79 coats, and 1 yd. 2 qr. 1 nl. left.
C. 1. 104d. 8h. 26m. 55s.
2. £66 0s. 1¾d.—24,884.
3. 29 gross of needles.
D. 1. 223 ton, 14 cwt. 3 qr. 23 lb. 5 oz.
2. 646,719¾ sq. ft.
3. £546,057 3s. 6¾d.
E. 1. 209,952 c. in.
2. 8s. 6½d.
3. 13s. 7½d.—29,710.
F. 1. 3 ton 12 lb.
2. 15,488d. 4h. 37m. 39s.
3. 1,212,960 beans.

ADVANCED EXAMINATION.

1. 2760 oranges.
2. £12 7s. 6d. each ox.
3. 153 caps.

STANDARD V.

A. 1. £28 7s. 9¾d.
2. £641 0s. 7½d.
3. £2877 1s. 8¼d.
B. 1. £3342 4s. 8½d.
2. £8437 18s. 5¼d.
3. £7219 14s. 0½d.
C. 1. £41,250 4s. 3d.
2. £255,684 17s. 5d.
3. £58,654 6s. 3d.
D. 1. £394 15s. 8¾d.
2. £8032.
3. £599 3s. 8½½d.
E. 1. £5,201,857 11s. 6½d.
2. £3378 18s. 1½d.
3. £1437 3s. 2½d.
F. 1. 90.
2. £44 11s. 3d.
3. £87 0s. 4½d.

ADVANCED EXAMINATION.

1. £7 11s. 11½d.
2. £167 6s. 10½d.
3. 8s.9d.m.,6s. 3d. w., 2s.6d. b.

STANDARD VI.

A. 1. $31\frac{4}{15}$.
2. $4\frac{1}{10}$.
3. $\frac{4}{77}$.
B. 1. ·61875.
2. 2000.
3. 4s 1½d.
C. 1. $31\frac{1}{8}\frac{7}{8}$ acres.
2. $3\frac{5}{8}$ hours.
3. $6\frac{1}{3}\frac{3}{3}$ hours.
D. 1. $2\frac{2}{3}\frac{2}{3}\frac{2}{3}$.
2. $\frac{4}{5}\frac{4}{6}\frac{4}{7}\frac{4}{8}$.
3. £1214 3s. $8\frac{1}{2}\frac{1}{5}$d.
E. 1. £7 16s. 8¾d.
2. 741$\frac{1}{2}\frac{1}{8}$ oz.
3. 281¼ yds.
F. 1. ·063.
2. ·01103+.
3. 68 to 75 (A to B).

ADVANCED EXAMINATION.

1. 5 to 4.
2. 29$\frac{1}{2}\frac{1}{3}\frac{1}{5}$.
3. £166 4s. 8·808d. (gain).

STANDARD VII.

A. 1. £1 2s. $1\frac{2}{3}\frac{1}{3}$d.
2. £126 19s. 10½d.
3. $2\frac{1}{2}\frac{1}{4}$ per cent.
B. 1. 1,025,750 min.
2. ·0008701+.
3. £6 10s. 7½d.
C. 1. $3\frac{4}{1}\frac{4}{1}\frac{4}{6}$ years.
2. 7500 persons.
3. £3716 8s.
D. 1. £2272 14s. $6\frac{4}{1}\frac{4}{1}$d.
2. £4350.
3. £149 9s. 6·127872d.
E. 1. £38$\frac{1}{4}$.
2. £6 11s. 2½d.
3. £100 17s. 7½d.
F. 1. 63·25.
2. 3·75.
3. $85\frac{1}{7}$ per cent.

ADVANCED EXAMINATION.

1. 53$\frac{1}{3}$m. past 12.
2. £6690 14s. 0$\frac{1}{2}\frac{1}{3}$d.
3. 235·339+ yards.

SOLUTIONS OF THE 'ADVANCED EXAMINATION' QUESTIONS IN 'THE SCHOLAR,' FOR MAY, 1882.

STANDARD III.

1. 1200 × 5 = 6000 herrings bought.

	£	s.	d.
1000 sold at 1d. each =	4	3	4
3500 „ „ ½d. „ =	7	5	10
1500 rem. „ 5 for a d. =	1	5	0
Total selling price =	12	14	2
Deduct the cost =	10	17	6
Gain	£1	16	8 Ans.

2.

£	s.	d.
7,012,010	0	2
81,016	0	4½
£6,030,093	10	9½ Ans.

3.

£	s.	d.	
1	17	6½	baker's bill.
0	16	10½	
2	14	4½	butcher's bill.
4	11	11½	sum of the two bills.
0	12	6	
3	19	5½	grocer's bill.
8	11	4½	draper's bill.
		2	
£17	2	9	Ans.

STANDARD IV.

1. 60 is a number of dozens and also a number of fives, and 60 cost 4½d. × 5 = 1s. 10½d., and there being 12 fives in 60 they will sell for 2d. × 12 = 2s.; hence the gain on 60 oranges is 2s. − 1s. 10½d. = 1½d. Then 5s. 9d. ÷ 1½d. = 46 the number of *sixties* bought, and 60 × 46 = 2760 oranges. Ans.

2.

£	s.	d.		£	s.	d.
22	15	0	× 20 =	455	0	0
17	2	6	× 50 =	856	5	0
			70 =	1311	5	0

£1277 10s. + £157 10s. = £1435 total selling price; then £1435 − £1311 5s. = £123 15s. selling price of the remaining 10 bullocks, and £123 15s. ÷ 10 = £12 7s. 6d. Ans.

3.

	yds.	qr.
2 yd. 3 qr. 1 nl. × 24 =	67	2 coats.
2 qr. 2 nl. × 18 =	11	1 vests.
	78	3 coats and vests.

Then 100 yds. − 78 yds. 3 qr. = 21 yds. 1 qr. for caps. Bringing both 21 yds. 1 qr. and the 2 nl. ½ in. to inches, we have 765 in. ÷ 5 in. = 153 caps. Ans.

STANDARD V.

	£	s.	d.
1. 14 lb. at 1⅛d. an oz., *i.e.*, 2s. 4d. a lb. =	1	12	8
21 lb. or 1½ st. at 27s. 4d. a cwt., *i.e.*, 3s. 5d. a st. =	0	5	1½
1½ cwt. or 168 lb. at 6½d. a lb. =	4	11	0
3½ oz. at 6s. a lb., *i.e.*, 4½d. an oz. =	0	1	3½
2½ cwt. at £15 15s. a ton, *i.e.*, 15s. 9d. a cwt. =	1	15	5½
4 lemons, *i.e.*, ⅓ of a doz., at 7½d. a doz. =	0	0	2½
	8	5	9
Less 165¼d., as £8 5s. 9d. = 165¾s.	0	13	9½
Ans.	£7	11	11½

2. 1 qr. 3½ lb. = 31½ lb. × 150 = 4725 lb., 3s. 10½d. ÷ 11 = 4½d. price of *half* a lb., or 8½d. a lb.; 4725 lb. at 8½d. = £167 6s. 10½d. Ans.

3. Bringing all the shares to their equivalents in boys' shares we have—

48 boys' shares = 48
18 men's shares = 18 × 3½ = 63
32 women's „ = 32 × 2½ = 80

Total boys' shares = 191

£	s.	d.		s.	d.	
Hence 23	17	6	÷ 191 =	2	6	a boy's share
0	2	6	× 2½ =	6	3	a woman's „
0	2	6	× 3½ =	8	9	a man's „

Ans.

STANDARD VI.

1. 80 × 5 = 400 lb. eaten by 40 men in 6 days, hence 400 lb. ÷ (40 × 6 = 240) = 1⅔ lb. eaten daily by a man.

Again 240 × 4 = 960 lb. eaten by 90 women in 8 days, and 960 lb. ÷ (90 × 8 = 720) = 1⅓ lb. eaten daily by a woman. Hence the ratio is 1⅔ to 1⅓, that is, 5 to 4. Ans.

2.

$(2\frac{3}{5} + 5\frac{3}{8}) = (2\frac{24}{40} + 5\frac{15}{40}) = 8\frac{39}{40}$ sum
$5\frac{3}{8} - 2\frac{3}{5} = 3\frac{7}{40}$ diff.
$(2\frac{3}{5} \times 5\frac{3}{8}) = (\frac{13}{5} \times \frac{43}{8}) = 15\frac{39}{40}$ prod.
$(5\frac{3}{8} \div 2\frac{3}{5}) = (\frac{43}{8} \times \frac{5}{13}) = 1\frac{7}{104}$ quot.
$(2\frac{3}{5} \div 5\frac{3}{8}) = (\frac{13}{5} \times \frac{8}{43}) = 2\frac{18}{43}$ quot.

$20\frac{1133}{1560}$ Ans.

N.B.—The least common denominator is 13650.

3. 10·375 × 2240 = 23240 lb. of currants. 23240 ÷ 2 = 11620 lb. at ·085 cr., *i.e.*, £·02125 a lb., 2·06 × 2240 = 4614·4 lb. at ·0275 of 15s. 9d., *i.e.*, at £·02165625 a lb., and 23240 − (11620 + 4614·4) = 7005·6 at £·0185 a lb. And 295·45 guineas = £310·2225, then

£·02125	× 11620 =	£246·925
£·02165625	× 4614·4 =	99·9306
£·0185	× 7005·6 =	129·6036
Total selling price		£476·4592
Deduct cost		£310·2225
		£166·2367 =

Ans. Gain £166 4s. 8·808d.

STANDARD VII.

1. First find the fraction of an acre mown by A and B before C comes at 7.30, A having been working 1½ hours and B ½ hour, and having done respectively $\frac{3}{20}$ and $\frac{1}{16}$ ac.

Hence $\frac{3}{20} + \frac{1}{16} = \frac{17}{80}$ ac. done at 7.30.
$1\frac{7}{8}$ ac. = $\frac{15}{8} = \frac{1500}{800}$, $-\frac{17}{80} = \frac{170}{800}$ ac. to be done by A B and C.
$\frac{1}{10} + \frac{1}{8} + \frac{1}{12} = \frac{37}{120}$ frac. of ac. done in an hour.

Then $(\frac{1330}{800} \div \frac{37}{120}) = (\frac{1330}{800} \div \frac{74}{240}) = 5\frac{20}{74}$ hrs. = 5 hrs. $23\frac{19}{37}$ m., time occupied after 7.30 a.m., hence the work is finished at 12.53$\frac{19}{37}$ p.m. Ans.

2.

	£	
$\frac{1}{20}$	6000	worth at 16
	300	less £175 = 1st year's saving.
$\frac{1}{20}$	6125	worth at 17
	306·25	„ 2nd year's saving.
$\frac{1}{20}$	6256·25	worth at 18
	312·8125	„ 3rd year's saving.
$\frac{1}{20}$	6394·0625	worth at 19
	319·703125	„ 4th year's saving.
$\frac{1}{20}$	6538·765625	worth at 20
	326·93828125	„ 5th year's saving.
	6690·70390625	= worth at 21
£6690 14s. 0 $\frac{1}{16}$d. Ans.		

3. 300 × 200 = 60,000 sq. yds., area of the rectangular field. As the square field is £65 an acre, and the other only £60, the required field will be only $\frac{60}{65}$ or $\frac{12}{13}$ of 60,000 sq yds. 55384·615384 + sq. yds., area of the square field But the area of a square is the square of the side, hence the square root of this number is the length of the side = 235·339+ yards. Ans.

THE COUNCIL OF THE MICE.

Allegretto spiritoso. *mf* — *Music by* T. CRAMPTON.

1st TREBLE.
2nd TREBLE.
BASS.

1. One sum - mer eve, when all was still, When not a soul was wak - ing, When
2. In so - lemn rows they sat a - round, Their mourn - ful fate la - ment - ed, How
3. At last a mouse of as - pect grave—While thoughts of woe dis - tressed them— A
4. They hailed with joy the words which fell, In songs of tri - umph sang it; But

KEY A. *Allegretto spiritoso. mf*

1st TREBLE. ,s, | m ,d .d .d :d ,d .d .d | r ,m .f ,s :m ,d . ,d
2nd TREBLE. ,m, | s, ,s, .s, ,s, :s, ,s, .s, ,s, | t, ,d .r ,t, :d ,m, . ,s,
BASS. ,d, | d, ,m, .m, ,m, :m, ,m, .m, ,m, | s, ,s, .s, .s, :d, .d, . ,m,

fai - ries danced by ev - 'ry rill, And elves a stroll were tak - ing— With - in a farm - er's
cats their dear - est haunts had found, And all their lives tor - ment - ed. "Is there no way," they
joy - ous squeak of tri - umph gave, And in these words ad-dressed them: "A - round his neck we'll
when the mouse pro-duced the bell, No one was found to hang it! So, still the cat, with

E. t. f. A.

t,m ,s .s ,s :s ,s .s ,m | r ,m .f ,s :m ,d . | d s, | s, ,m .r ,d
s,d ,m .m ,m :m ,m .m ,d | d ,d .t, ,t, :d ,d . | ta, f, | m, ,s, .s, ,s,
s,d ,d .d ,d :d ,d .d ,m | s ,s .s, ,s, :d ,d . | m t, | d ,d .m, ,m,

emp - ty barn, In plea - sant sum - mer wea - ther, The mice, se - cure from chance of harm, In
cried in grief, "This dread - ful foe to van - quish? No way for us to find re - lief From
hang a bell, And, in a mo - ment's twink - ling, Of his ap-proach 'twill sure - ly tell, And
foot - step light, The mice is still tor - ment - ing; And still in ma - ny a quiet night We

:t, ,l, .l, ,l, | l, ,f .r ,d :d ,t, . ,s, | s, ,s .m ,d :l, ,r .f ,r
:f, ,f, .f, ,f, | f, ,l, .f, ,f, :m, ,r, . ,f, | m, ,m, .s, ,s, :f, ,f, .l, ,f,
:f, ,f, .f, ,f, | r, ,r, .f, ,f, :s, ,s, . .t, | d ,d .d ,m, :f, ,f, .r, .r,

Symph.

coun - cil met to - ge - ther,
days and nights of an - guish?"
warn us by its tink - ling."
hear the mice la - ment - ing.

Symph.

t, ,d .r ,m :r ,d . | s | f ,l .s ,f :m ,s .f ,m | r ,m .f ,s :m ,d .-
r, ,m, .f, ,s, :f, ,m, . | d | t, ,d .r ,s, :d ,ta, .l, ,s, | t, ,d .r ,f, :d ,s, ,m, .-
s, ,s, .s, ,s, :d, ,d, . | m | r ,d .t, :d .d, | s, ,s, :d
,s2 :d,

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Vol. I. of the *Practical Teacher* is now out of print.

The New President of the National Union of Elementary Teachers.

WE this month present to our readers a portrait of Mr. Richard Sykes, the new President of the National Union of Elementary Teachers. Mr. Sykes is a native of Yorkshire, and it was a happy coincidence that he should have been called upon to preside over the annual conference in the county of his birth, and within so short a distance of Dewsbury, his native town. Born in February, 1841, Mr. Sykes is now in his forty-second year. He, however, looks younger, and we believe that even few of his colleagues on the Executive credit him with the full experience his long professional career has given him.

He was educated in the National School, Dewsbury, and afterwards became a pupil teacher in the same school. At the close of an apprenticeship of five years, during which he had won the esteem of all connected with the school, he obtained a Queen's Scholarship, and in 1861 entered the York Training College. Here he remained for two years, and after passing with success the various college and Government examinations, he was, early in 1863, appointed to the Head Mastership of the National School, Hyson Green, Nottingham. In this school Mr. Sykes remained for a period of sixteen years, during which he succeeded in raising it to a high pitch of excellence, gaining year by year excellent reports from Her Majesty's Inspectors. In 1879 he was appointed by the School Board for London to the Head Mastership of the Gillespie Road Board School, Highbury, N., a position he still occupies, and in which he has continued his successful professional career.

Mr. Sykes has always taken great interest in the work of Teachers' Associations, and was an active member of the 'Associated Body of Church Teachers.' He was the Secretary of the Nottingham branch when the 'Associated Body' held its last conference in that town in 1870. At this meeting, which was attended by Mr. Thomas Smith, as the representative of the London Church Teachers, it was agreed to dissolve the denominational 'Body,' and a resolution was carried in favour of establishing a union embracing all sections of teachers

For the active part taken by Mr. Sykes in this conference, and for his fervour in supporting the movement for substituting a general professional union for a sectarian organisation, he was nominated by the officers of the 'Associated Body' to the post of First President of the National Union. He, however, declined the honour, on the ground that in the interest of the new Union a man of greater age and experience should be appointed. Mr. J. J. Graves, who had been the General Secretary of the 'Associated Body' for some time, and who had probably devoted more time to the organisation of the profession than any other living teacher, was ultimately nominated and elected as 'First President of the N.U.E.T.'

Mr. Sykes was present at the first conference of the Union, held in King's College, London, as a representative of the Nottingham Association. In supporting the following addendum to the 'Objects of the Union'—'to raise a fund to secure to teachers public protection and social security'—he said:—

'The National Union, unlike its predecessor, the "Associated Body," threw open its doors to all sections of Elementary Teachers, and its Executive, instead of being scattered throughout the country, were concentrated in the metropolis. These were great steps in advance. Like former associations, however, it lacked one vital element of success and permanency, without which its career would be fitful, short, and comparatively useless. This necessary element was a large fund of money, which would serve as a fortress behind which they might entrench themselves against all assailants, and which should enable them to speak boldly and determinedly upon all questions that concern the welfare of those they strive to protect. Teachers could not be expected to subscribe their money unless real, tangible benefits could be secured to them in return. Let the Union adopt a bold, vigorous policy, and these benefits would easily follow. Let it declare that it aimed at succouring the oppressed, relieving the sick, assisting the unemployed; that it strives to infuse into each individual member independence and courage to withstand those who would degrade his position, by imposing upon him labours foreign to school work, or incompatible with the dignity of his profession. Let it assist each member to obtain a remuneration commensurate with his services, and secure to him a certainty in the tenure of his office.

'There is nothing Quixotic or chimerical in striving to attain these objects. They cannot be attained in any other way than by assimilating the National Union to that of a Trades' Union, devoid of its evils. An association aiming at the realisation of such tangible objects would not fail in drawing towards it the great majority of the Elementary Teachers of the country; and

they would not demur to pay sixpence or a shilling per *week* instead of per *annum*. If two-thirds of the teachers in the country subscribe sixpence a week, what a powerful fund would be accumulated in one year. The subscription of 10,000 teachers at this rate would amount to £13,000 per annum. A fund like this would enable the union to take immediate action on all questions concerning the welfare of its members, individually and collectively. Paid officials would be employed, who would devote their whole time and energies to the work, would listen to their grievances, and endeavour to remedy them. Each teacher would perceive it was his special benefit to join, and that his money would not be fruitlessly and vainly spent. A National Union worthy of the name, embracing in its fold its thousands, would then be founded, and would have within it the elements of permanency and success.'

The Nottingham idea was not accepted at the time, but two years later the third annual conference at Manchester practically endorsed the proposal.

idea of a Conference Bazaar, carried out with so much success at Nottingham in 1879. At the twelfth conference of the Union, held in Lambeth last year, Mr. Sykes was elected by a large majority the Vice-President of the Union, and he now succeeds Mr. Langler, B.A., as President.

While in Nottingham Mr. Sykes did not confine his attention to the mere routine of his scholastic and professional duties, but took an active part in the promotion of general education. In conjunction with the Rev. J. B. Paton and others, he aided in establishing the series of evening schools and classes for technical and industrial instruction which have done, and are still doing, so much for the trade and town of Nottingham. In this respect Mr. Sykes has shown himself to be an able and enthusiastic educationist. He had earned the respect and

We believe that the views of Mr. Sykes on the policy of the Union have not undergone much change since 1872, though the experience he has acquired during the past ten years, by a wider acquaintance with teachers, and the greater knowledge of public work and business he now possesses, have modified his ideas as to the means by which effect may be given to this policy.

In 1873 Mr. Sykes was one of the selected candidates for the post of General Secretary of the Union, and stood second in the election at Bristol, when Mr. Heller was appointed to that office. He filled all the offices of the Nottingham Association, and represented it in nearly all the annual conferences of the Union since 1872. He was the First President of the North Midland District Union, doing good service in that capacity and in the earlier arrangements for the Nottingham Conference. Mr. Sykes has been from the first an earnest supporter of the Teachers' Benevolent and Orphanage Fund. For three successive years he has been Chairman of the Council of the Orphanage and Orphan Fund, and to him may be attributed the first

gratitude of his fellow-teachers by his devotion to their interests, and we congratulate the union in securing so suitable a man as its thirteenth President. We wish him much success in his year of office, and we have little doubt that the vigour, enthusiasm, and experience which he possesses, will carry the National Union to higher points of success and influence than it has previously attained.

—o—

Monthly Notes.

THE NATIONAL UNION OF ELEMENTARY TEACHERS.—ANNUAL CONFERENCE AT SHEFFIELD.

THE Thirteenth Annual Conference of the National Union of Elementary Teachers was held at Sheffield during Easter week. Owing to its convenient and central position the great manufacturing town in South Yorkshire was well attended by the representatives of the

numerous branches of the parent Union, and the Conference was one of the most successful that has been known. Many teachers were, no doubt, induced to attend from the fact that Sheffield is within easy reach of some of the best scenery in England—that about Chatsworth and Matlock; and others were perhaps tempted to put in an appearance by the attractions of the 'Old English Fayre,' which formed a prominent feature of the proceedings, and proved a great financial success. Mr. Mundella, Vice-President of the Committee of Council on Education, was present at the Annual Banquet in the Albert Hall, and also at the 'Fayre,' which was opened by his daughter, in the absence of Mrs. Mundella, who was too unwell to leave home. The weather was exceedingly fine during the first two or three days, and, although it turned out very wet towards the end of the week, the Conference, of which we append a full report, passed off pleasantly, and was in all respects a success.

MONDAY.

The First Session of the Conference was held at Firth College, on Monday, April 11th, the chair being taken at two o'clock by Mr. J. R. Langler, B.A., President of the N.U.E.T., who was accompanied to the platform by Mr. Sykes, the President elect, and the Executive of the Union. Mr. Langler having declared the Conference open, and the standing orders having been read, and the minutes of the last conference confirmed, a vote of thanks to the retiring president was moved by Mr. Dawson, and seconded by Mr. Bowden. After the hearty adoption of the motion by the meeting, Mr. Langler said :—

I can, to some extent, understand the great cordiality with which this generous vote has been received. I am here in the midst of many old friends, some of whom I have not seen since they were at college, and who, though they recognise me, would probably be not so readily recognized in return. I cannot assent that the office has been a sinecure. Many have been the anxieties of the year, especially in connection with the New Code, and heavy indeed has been the labour, but the ready vigour of the Vice-President, the hearty co-operation of the members of the Executive, and the never-failing care of the Secretary have enabled me to discharge the duties entrusted to me twelve months ago. I am happy to know that our Union is increasing not only in numbers but also in influence. It is not a great unwieldy body without vital power. All its parts do not as yet exhibit equal signs of life, but I believe that as our principles are better understood very few qualified teachers will hesitate to accept them, and I confidently expect a rapid accession to our influential as well as to our numerical strength. I assure you I leave this chair with confidence to my successor, Mr. Sykes, who, with more youthful vigour, and equally earnest devotion, will for the next year occupy the proud position of President of the National Union of Elementary Teachers. I have now great pleasure to introduce Mr. Sykes.

Mr. SYKES, who was received very heartily, then proceeded to deliver his address, of which we give the most noteworthy passages :—

Ladies and Gentlemen,—In bidding you a hearty welcome to this, our twelfth, annual Conference of the National Union of Elementary Teachers, I have to congratulate you upon its continued prosperity, progress, and usefulness; and upon its increase of 1,200 members during the past year. Three hundred and twenty associations, which embrace within their folds more than 13,000 teachers, are now affiliated to the Union. We have thus active and vigorous branches spreading themselves throughout the whole of England and Wales. The continued success and prosperity of our organization is cheering to us, and gives us hope that gradually the great majority of elementary teachers will consider it their duty and privilege to range themselves under its banner. Attempts from time to time have been made to engraft new principles upon the organization. Many ardent Unionists believed that these principles would have secured a more numerous following and achieved more rapidly solid and tangible results. The Union, however, has been slow to adopt any principles which would have proved unacceptable or obnoxious to the outside public. Yet, withal, its steady progress, its acknowledged usefulness, its many achievements, have won for itself the admiration and devotion of all true believers in the future prosperity and usefulness of the profession it aims to protect, assist, and promote. It has laboured steadily and successfully to leave its impress upon the educational history of the last ten years. It has not hesitated to strike boldly at what it considered pernicious, and to advocate as resolutely what it held to be just and right.

The N. U. E. T. and the New Code.

The National Union of Elementary Teachers considers it its duty to oppose many of the additional requirements demanded by the 'Proposals for the revision of the Code.' Let it not, however, be inferred from this that the Union is in favour of a narrow and restricted curriculum for the children attending elementary schools. On the contrary, it has consistently advocated a generous and comprehensive education, limited only by the capacity of the children to receive it, and the time at the teachers' disposal to impart it. A syllabus which aims at more than this will inevitably result in disappointment. The overcrowding of the mind will only result in confusion. In the estimation of the Union, the present Code contains ample materials for the furnishing of the intellect of the children attending our schools. Our desire should not be to increase the quantity of knowledge imparted but to improve the quality. It is impossible to crowd into school-life all the varied subjects which the fancy of specialists desire. 'Music is charming;' therefore, say the musicians, 'Compel all our children to sing by note.' It is essential, in these æsthetic times, that our clothes should be properly made; 'therefore compel every little girl to become a perfect seamstress.' The poor man's dinner is not always properly cooked; therefore cooking must form part of the school work. The whims of the specialists carry them further than even such apparently necessary requirements as these. In America, one authority on education believed in the necessity of telegraphy; therefore every child in his school was set to work clicking at telegraph keys. And even in one of the School Boards in England, a member had a craze for the subject of phrenology; therefore he gravely advocated the necessity of phrenology as a subject that should be understood by the teachers, and taught in the schools. All these subjects may be essential to the complete education of our children; but is it necessary that they should be compulsorily taught? Let the subjects in the schedule of specifics be as numerous as possible. But let the selection be left with the teachers, that they may be able to adapt their teaching to the requirements of their district, and to select those subjects which they feel specially able to teach.

Classification of Children.

Children may be divided, according to their mental ability into three classes—the clever, the dull, and the average child. The knowledge of this fact would always be present before a teacher, when classifying his children, if his liberty of action were not crippled by the irrational and absurd classification by age demanded by the Government Code. A teacher, anxious for the progress of all his children—the dull and the clever, the forward and the backward—would, as much as possible, arrange children of similar attainments together. He would never dream of allowing the disparity which now exists between the two ends of a class to continue for twelve months at a stretch. He would never allow the quick children—the hares in the race—to comparatively waste six months of the year in order that the slow-paced or snails, might reach the same mark before another onward start was made. As soon as one portion of ground was well travelled over, thoroughly surveyed and known, an advance forward into fresh pastures would be made. The snails would crawl along at a pace compatible with their abilities. Special help would, of course, be rendered them. The teacher would, however, take care that they travelled along the road with those they would not be a drag upon, but with those with whom they were fairly handicapped, and with whom the emulation engendered by a chance of winning would operate in spurring them on to exert themselves to reach the goal as rapidly as their scant abilities would allow. Let classification by merit operate, and at once would cease that dull level of mediocrity which so often characterizes the children in our schools. We should see our upper classes more forward in their work, and pursuing studies which now have no place in the school; and the teacher would not be disheartened by the serious loss of time and energy necessitated by the vain attempt to drag the dull up to the level of the quick.

Teachers' Certificates.

The teachers' certificate has had a most chequered career. Its transformations have been varied and peculiar. Doubt and uncertainty have always hung around it. Originally money value attached to it. It was then a prize worth possessing, and only those qualified by good scholarship could win it. In 1862 the New Code ruthlessly swept away all that gave it dignity and worth. During the ten years that the shadow of Mr. Lowe's Code brooded over the land the certificate was a distinction scarcely worth struggling for. It was distributed among persons possessing very little scholarship, and few of the qualifications for the post of teacher. Subsequent revisions of the Code have attempted to either improve or impair its power and dignity. They have either added to or diminished the amount of knowledge required to obtain it. It has never been the complete possession of its owner. Government has always retained a hold over it, and has, at its discretion, cancelled or suspended it, and endowed it with a favourable or unfavourable report. It has, in fact, been made rather a weapon wherewith to correct and chastise, than

an honourable distinction of which one might feel proud. The present Vice-President, however, has striven to free the certificate from some of the imperfections which tended to detract from its dignity and value. No teacher, unless he has passed in the second year's papers, will be allowed to teach pupil-teachers. No certificate in future will be granted without examination. And after a first-class has been obtained, the annual endorsement will cease. These are satisfactory steps in the way of improvement. 'My lords,' however, are of opinion that the certificate, thus elevated and improved, does not represent sufficient scholarship for our future elementary teachers. Inducements, therefore, are held out for university graduates to our ranks. Graduates are promised that they will become eligible for head-masterships in our schools if they work one year as assistants, and earn the certificate by examination. Few graduates, except the worthless, will be attracted to our work by this simple bait. Those who offer themselves as assistants will have, no doubt, looming before their eyes the inspectorate. It is possible that in future even inspectors' assistants, from whom sub-inspectors are to be made, will not be appointed unless they have graduated at one of our universities. It must be a source of pleasure to all earnest educationists to find that the university degree is not considered too high a mark of scholarship for teachers in elementary schools. This is a great step in advance from the gloomy period ushered in by the Revised Code. Let us hope that the time is not far distant when one of the essential qualifications for a public teacher will be the possession of a university diploma. The Hon. L. Stanley recently advocated in the columns of one of the magazines the opening of the universities to elementary teachers. He says:—'It is much to be wished that our old universities could open their doors somewhat to elementary teachers. At present unattached students at Oxford can live and study there for £50 a year. The State pays £100 for a student who completes two years at a training college; why should it not pay for a two years' residence at Oxford or Cambridge? In that case the universities might organize a course by which an elementary schoolmaster might graduate there, and so come in contact with a wider range of social influence than he now does at the training college; and the universities might appoint special teachers who would give instructions in all the branches, which are more especially needed for schoolmasters.' If this advice were acted upon, our present training colleges might be utilized as training institutions in the art of teaching, and subserve the same purpose as the hospital schools for the medical profession. During almost the whole of the two years spent at a training school, a student is engaged receiving instructions in similar subjects to those required for the examination of the B.A. degree. At the most, a month or six weeks are spent in the practising and model schools learning the newest methods, and seeing the supposed best arrangements and organizations of schools. This could easily be provided by each university town. Professors of the art of teaching would be able at the universities to give far superior insight into the methods of teaching and training the young than that given by the method masters at our training colleges; for our training college method teachers are not, as a rule, selected because of their eminence in the science of teaching, but chiefly because they are prepared to accept a scanty remuneration for the work. The teacher's diploma would, of course, demand practical skill in the art of teaching. This would be as necessary as the skill required by the doctor before he is allowed to minister to the sick; or the lawyer before he is permitted to practise in the courts. A compulsory system of apprenticeships for all teachers would ensure that this practical skill were possessed. Each university town could easily adapt one of its elementary schools to that of a model school in connection with a training college. The best appliances, the most approved methods, and the most skilful teachers might be seen in it. It might, in fact, afford to the university student ample opportunity for gaining an insight into the best modes of organizing and conducting a school.

Concluding Remarks.

The necessity for a powerful and vigorous organization becomes yearly more patent. After this Conference let each of us return to our respective districts firmly resolved to do our share in rousing our brethren to activity and zeal in behalf of our cause. Let us strengthen our Union by rallying to its standard those who yet stand aloof from us. The National Union of Elementary Teachers has achieved much in the past. It has much yet to accomplish. It will, I believe, be the main instrument in elevating our profession to that position its dignity and importance deserve. Let us, above all, ever keep before our gaze a lofty ideal of our work and of our responsibilities. Let us lose no opportunity to foster pure thoughts and noble motives in the minds and hearts of the children entrusted to our charge; and, amid the gloom and depression that Codes and examinations may cast around us, let us not lose heart, but be sustained by a firm and sure conviction that, if our work be rightly and faithfully done, our reward will be seen in the purer and better lives of the generation that shall come after us.

Mr. GIRLING said it was a pleasure to move a vote of thanks to the President for his services during the past year as Vice-president, and for the address he had just given them. He had assiduously discharged his duty in the past, and the address was a most able one. The motion, having been seconded by Mr. Hodgson and put to the meeting, was carried with acclamation, and was acknowledged briefly by Mr. Sykes. The report of the executive to Conference for the past year was then read. It touched upon the relations of the Union with the Education Department, the Inspectorate, supply of Teachers, Pensions and Compulsory Annuity Fund, Parliamentary work of the year, the Goffin case, the Appointment of Inspectors, Organization and Finance, Co-operation with other Public Bodies, the Union's Executive Machinery, and References from the last Conference. Mr. Wild moved, and Mr. Traill seconded, a resolution to the effect that the Report should be received, adopted, and printed for circulation, which was agreed to unanimously. After this Mr. Clark moved a resolution respecting the appointment of the Assistant Secretary, which submitted that the election was not made in accordance with the spirit of the resolution passed at the Lambeth Conference. The discussion was continued by Messrs. Sadd, Clarkson, and Pitt, after which Mr. Langler explained the circumstances of the appointment and said that he had no doubt about Mr. James doing his work well. The resolution was lost by a large majority. The Treasurer's Report and the Report of Auditors, which, together showed the Financial affairs of the Union to be in a flourishing condition, were then read and ordered to be printed. Votes of thanks to officers for their services during the past year were carried unanimously, as was also a motion for the reception of the reports of the Teachers' Benevolent Fund, the Orphanage and Orphan Fund, and the Teachers' Provident Society.

The Second Session was held in the evening, when Mr. Greenwood moved a vote of thanks to the Education Department for their efforts in the cause of education. He said that Lord Spencer and Mr. Mundella had honestly striven to do their best, and the thanks of teachers were due to them. Mr. Rankilor seconded the resolution, which, after some discussion, was carried by a large majority. The President then announced that Mr. C. J. Dawson, B.A., had been elected Vice-President for the ensuing year. Mr. Dawson, who was much cheered, said that they had conferred a great honour upon him. He would strive during the time of his probation to make himself worthy of their confidence. A very excellent and interesting paper on 'The Further Education of Children after leaving the Day-School,' was then read by Mr. L. W. Potts, who was heartily thanked for his kindness, on the motion of Mr. Carlyon. Mr. Heller moved:—

'That in view of confirming and extending the education of children leaving day-schools, some systematic scheme of work connecting these schools with technical and scientific institutions is both necessary and desirable.' He believed that the country owed more in the way of real secondary education, and in the way of advancement from the lower classes to the higher, to the elementary teacher than to any other class. It had long been a trouble to the teachers to find much of their labours had been thrown away by the lack of a proper bridge between the lower schools and the higher. Teachers had done something themselves to make up for this deficiency. They wanted their schoolchildren to have some systematized means of extending their further education. There was, unfortunately, a great tendency at the present day to act as though people had no practical belief in education, and he wanted that Conference to speak out boldly on the point. He did not believe in the cry of over-education; so far from that, our country was falling behind in the race, and they must improve it by extending their education. Moral improvement for their old scholars, also was wanted, and if they took hold of their children at a critical age and gave them employment, it would do great good. He wanted the country to see that the elementary teachers were in earnest over this cause.

The resolution having been supported by Messrs. Baker, Thornton, and Traill, was carried. Mr. Langler then brought up the report of the Special Committee on Constitution and Election of the Executive, which was received. The Conference then adjourned, on the motion of Messrs. Bowden and Moore.

TUESDAY.

The Third Session was held on Tuesday morning. After the consideration of a motion respecting quarterly drawing examinations and its negation by the meeting, Mr. A. E. Kirkham read a paper on 'Thrift among Teachers,' in the course of which he enumerated some of the advantages of the Teachers' Provident Society. He said their duty was plain. It was to assist ungrudgingly, and to the best of their ability, those of their brethren who were poor and helpless, and the fatherless and the widow. They would do this all the more thoroughly by practising those habits of Thrift which fill the open hand of charity, and without which benevolence itself would be little more than a name. After the reading of his paper Mr. Kirkham proposed :—

'That in the opinion of this Conference, the Teachers' Provident Society affords to teachers exceptional advantages, and is deserving of their cordial support.'

The resolution was warmly supported by Messrs. Greenwood, Gardner, Day, and Langler and was carried unanimously. The Scotch and Irish Deputations were then introduced to the Conference by the President and accorded a cordial reception. Mr. Mackay and Mr. McMillan, the Scotch delegates, addressed the meeting and were followed by Mr. O Farrell, the Irish representative, whose fifth attendance this was. Votes of thanks were accorded to the Deputations, on the motion of Mr. Langler, seconded by Mr. Dawson, and supported by the President. Mr. Scotson moved—

'That it is desirable that steps should be taken to secure the direct representation of teachers in Parliament,'

and said that when the rapid growth of education was considered, it would be seen that no class required more direct representation in Parliament than teachers. Mr. Girling seconded the resolution, which was carried by a large majority, after which the Conference adjourned.

The 'Olde English Fayre' at the Cutlers' Hall was opened at one o'clock by Miss Mundella, who was accompanied on the platform by Mr. Mundella, the Mayor of Sheffield, the Master Cutler, and many others. A procession of the stall-holders, who were attired in picturesque costumes of bygone days, was held round the banqueting hall before the opening ceremony commenced. The Mayor having expressed the pleasure he felt in presiding, introduced Miss Mundella, who begged to assure those present of her mother's great regret that she was unable to be present on that very interesting occasion. She heartily wished success to the efforts of all its kind friends throughout the week, and had great pleasure in declaring the bazaar open.

Mr. MUNDELLA, who was received with loud and prolonged cheers, said :

They were to do the best they could to realize an object which ought to be at the heart of every elementary teacher, and it was becoming in the English public, who owed so much to the teachers, that they should assist to the utmost in their power to realize that which the teachers aspired to—to help those who were afflicted and distressed in the time of their utmost need. He was speaking rather to those who were outside the ranks of elementary teachers, and he wanted to plead in a few words—they would be inadequate, perhaps, to the occasion—for the object which the teachers had in view that day. None knew better than he did how much that Benevolent Fund was needed. He would say nothing of the orphan fund—that must be known to everybody. Gaps in the ranks of the bread-winners were constantly occurring, and there must be need frequently to find some home for an orphan child; but for the teacher who was stricken down by ill-health, mental or physical weakness, there was nothing but his own savings and such help as his brethren could render him in his distress. He knew of no class in the community who were so utterly helpless or so utterly deprived of the power of continuing their work as the teacher was either when his physical or mental health failed him or was lacking for the moment. There was nothing, too, that demanded the full exercise of all the human powers of mind and body more thoroughly than the teaching of a school, and there was nothing more distressing than to see a teacher in failing health, in suffering, and especially in mental distress, endeavouring to teach a school. During the last week he had the painful task—it was one of the most painful tasks of the year—of distributing the few pensions and the few gratuities that were allotted. It was the fourth or fifth time he had had to do it, and he, therefore, knew something of the condition of the elementary teachers. He knew in how many instances, without any fault on their part, by a sudden visitation of Providence, many a teacher was stricken down, rendered helpless, and brought into the greatest distress. Sometimes it was a sudden failing of eyesight; sometimes a sudden failing of nerve power—and he could not conceive anything more needful than that the association should have the means of giving assistance at a time like that. Having said those few words, he wished to ask his Sheffield friends, as well as visitors from a distance, not to mind—what should he say—the trouble which ladies and gentlemen sometimes regard bazaars as causing, and not to say, 'Well, the articles are not useful,' and sometimes, perhaps, 'they are not ornamental,' but let them remember the good they were doing by contributing their mites to that most useful fund. Havind said that, having said all he could to induce his constituents, his friends around him from far and near, to open their purses and buy liberally, the best thing he could do would be to give them on opportunity of making their purchases, and to ask his friends to join him in making purchases as speedily as possible. He wished most heartily success to the bazaar, and to the cause for which the bazaar was promoted.

After a vote of thanks to Miss Mundella, the bazaar was opened for business, which went on briskly during the remainder of the week, the sum of two thousand pounds being cleared on the sales.

The Conference Dinner was held in the evening at the Albert Hall, which was tastefully decorated for the occasion. The President of the Union occupied the chair, and was supported by the Right Hon. A. J. Mundella, F.R.S., M.P., the Hon. E. Lyulph Stanley, M.P., the Mayor of Sheffield (M. H. C. Serby, F.R.S.), Mr. C. T. Whitmell, M.A., Mr. J. R. Langler, B.A., Mr. C. J. Dawson, B.A., and the Rev. Dr. Cocker. Amongst those present were the Rev. S. Earnshaw, Professor Carnelly, E. H. Hunter, Esq., the Master Cutler (J. E. Bingham, Esq.), Professor V. Jones, the Rev. W. H. Dallinger, F.R.S., the Rev. Canon Walshaw, the Rev. J. B. Draper, the Rev. H. Sandford, Mr. W. C. Leng, Dr. Howard, &c., &c.

After the usual loyal toasts, Mr. Heller proposed the toast of the 'Education Department,' and said he was glad that the respondent to the toast that evening was the virtual head of the department—Mr. Mundella. The anxiety and care which the the right hon. gentleman had shown on more than one occasion, clearly proved that he had the greatest sympathy with their difficulties, and in good time would do much for them. Mr. Mundella, who was received with great cheering, said :—

The Education Department has grown so rapidly, both in numbers and responsibilities, that it occupies a considerable space in the minds of men and in the Budget of the present day. The time will be in the recollection of most of you when the numbers on the roll of our elementary schools were under a million; and when the number of H.M.'s inspectors was some twenty or thirty. The whole thing was then in a nutshell, and was therefore much easier to handle than it is now. To-day the Education Department is responsible for the education of nearly five millions of the children of this country. It has relations direct and indirect with nearly a hundred thousand teachers; with some thousands of School Board and School Attendance Committees, and with many thousands of school managers; and automatically, by a process which nobody can prevent, I am satisfied that its annual expenditure must steadily increase. I don't regret that; I speak frankly. I rejoice at it. Indeed, perhaps, for a member of an economical Government, there is no man who has done so much in the past to promote that increase, and there is no man who will in the future do more to promote it than I shall myself. The Education Department, as Mr. Heller has said, is a very complicated body. He has spoken of its many members, and of its various ramifications. But there is one gentleman to whom Mr. Heller did not refer—I mean the Lord President.—I assure you there is no man to whom I am personally more indebted than to the Lord President for any support I have had in effecting any good in the way of promoting education or in ameliorating the condition of the teachers. It is not many noblemen who will forego all political patronage for the sake of improving the organization of the inspectors. The Lord President has done that. Since the present Government has been in office, there has been but one appointment to the inspectorate, and that was for Wales, where a Welsh-speaking inspector was required. All others had been kept in abeyance with a view to that reorganization which I think you all agree, the present condition of education requires, and with a view to ensure for teachers not young and inexperienced men, fresh from university, but experienced, practical, sensible, and just men, who will endeavour on some uniform principle, to meet out the awards and the honours of the Department. And I say that the Code which has now become law—it became law last week—

would never have been submitted to Parliament except on the condition that we could so reorganize the inspectorate as to ensure that its application should be even, uniform, and just. When you have a kindly word to say, or a kindly thought to express of the Department, let me commend to you the name of my noble friend Earl Spencer. (Cheers.)

Yours faithfully
A. J. Mundella

Mr. Heller has spoken of the permanent officials. With regard to that I must say that if any of you think hardly of the permanent staff in Downing Street, you do them a gross injustice. There is no class of men that I have ever come in contact with who are more desirous of being just, fair, and considerate than the heads of the permanent officials with whom I daily come in contact. More industrious and painstaking men I have never met with, and some of them do an amount of labour which I could hardly have given permanent officials credit for till I had myself been the witness of it, and till I had myself put their labour to the test. Let me now come to a class that you frequently speak of, I am afraid, with a little harshness, that you have all in your minds at this moment, and who have been for some time past objects of your apprehension, and lately of your suspicion—I mean Her Majesty's inspectors. (A voice: 'Some of them.') I am very glad to hear you say some of them; because in the ranks of Her Majesty's inspectors are some of the most distinguished educationists in the world. I am afraid to mention names lest I should be invidious, but I am sure some present will forgive me if I mention the name of Arnold. I mention it because of the illustrious educational descent he has—of his old services in the cause of education. There is the name of Fitch, the name of Sandford—aye, and let us be just, my friends, don't you know some inspectors' assistants? They were your former

colleagues in the work, and worthy of all honour, and esteem, and confidence. And do you think that those of us who have education at heart—not the education of any particular school, or of any class of schools, not Board schools, not voluntary schools, not this class or that class, for we want all the schools, and they are all indispensable and we can part with none of them—do you think those of us who have education at heart, when we come to reorganize our scheme of inspectors, shall not know our men, and shall not so select them that they shall discharge their duties with honour to themselves, with equity to you, and with satisfaction to the public? Passing from this part of this subject, I come to myself. Mr. Heller has spoken very kindly of what I have done—very kindly, but with qualified kindness. But I speak of Mr. Heller with unqualified kindness. I will say to you elementary teachers, you are fortunate to have your cause in his hands. It will be a bad day for you when you lose him, you will find it hard to replace him, for in all my relations with him—and my relations with him did not begin when I became Vice-President of the Council, they went a long way back, when I was advocating relief from many of your little grievances, and many of the frictions from which you have been relieved. All my relations with Mr. Heller satisfied me with his courtesy, his tact, his good judgment; his whole gentlemanly feeling in everything was so marked and conspicuous that you will do well to retain his services so long as he lives and you can keep them. (Cheers.) Mr. Heller made some reference to the Code. I am not going to justify my Code here. I leave the Code to justify itself, if it can, by time and experience. It may be defective, but whatever its defects may be, or whatever its merits, time and experience will try them, and I hope that I, or whoever may succeed me, will be sufficiently candid, sufficiently fair and just, if he finds defects, to know how to remedy them; but if he finds improvements he will not be wanting in courage to introduce them, and if he finds we are right, whether you approve or not, we must stand by it. All we desire is to give education to the people of this country, the success of education with as much happiness and comfort to the educators as is possible in any Code to administer: but, ladies and gentlemen, do not let me deceive you. Any one who tells you that the British Parliament will pay exclusively for machinery without any regard to results, that it will go on voting millions—and increasing millions—without any test or measurement, any one who tells you that will deceive you. I shall be no party to deceiving you. I have done my best to relieve you from everything that is harsh and derogatory—(cheers)—and I trust that in the working of the Code it will be found that we shall have less friction, more comfort, more success, and less of those harassing and unpleasant reminiscences such as attached to a great deal of the working in the past. But I will say this to you, I have thought this out on every side. I have been aided by the ablest men I could call in my Council—by your best friends. At the present time I can present to the British Parliament no better document for the regulation of the education of the country than the one which it has been my privilege to give to them, and I have found no scheme yet which entirely got rid of payment for results. (Hear, hear.) There is one scheme which will be submitted in a few days—and I took it up to scan it carefully—from a friend of mine, a former Vice-President—Lord Norton. (Applause and hisses.) What does he say? That Treasury aid might be given in general and tested reports on a graduated scale. Say, for example, to amount to one-half the nett cost of the school if it appeared, by frequent and casual inspection, and test examinations—considering always the circumstances of the school—that it was in vigorous work. ('Oh'.) To one-half, of that amount if the school be indifferently but honestly conducted, the passes of children not being considered up to fair expectations of the circumstances of the school. ('Oh'.) Whenever a grant is wholly withheld, specific grounds of refusal must be assigned. Well, I know this has been very carefully thought out. But what about the frequent and casual inspection and test examinations? Who is to decide whether a school is in vigorous work, or whether it is only indifferently but honestly conducted? The whole question then is to be absolutely in one lump in the hands of H.M. inspectors. I want to know what voluntary schools could carry on under the terror of losing one-half of the whole grant on the mere word of an inspector? You all know that is an impossibility. We have given you—we have exacted from you—I think that, Mr. Chairman, is the term—we are exacting 100 per cent. Nobody exacts or expects anything of the sort. It is an abuse of language to say we do exact it. The fact is, there is a standard, and I never heard of 100 per cent. being less than 100. I never heard of per cent. being less than 100, and I say this, we shall in future have passes weighed as well as counted, and the teacher who is the Arnold of the elementary school, who introduces kindliness, heartiness, intelligence, sympathy, into that school, will, I hope, be rewarded for that which now cannot be weighed and measured by the percentage of passes. Now, Mr. President, I read this morning with a good deal of interest your very able and eloquent address of last night. As your guest it would be ungenerous of me to criticise it, but let me say where I agree with you. I agree with you, sir, that we are only at the beginning of our educational system. We have a primary system, a system of elementary education, and then we have a blank. The last time I attended a meeting of elementary teachers it was in Boston, in the United States. Now we are grumbling about our expenditure here. I believe in London—that sink of extravagance—my hon. friend who will come after me will no doubt tell you something about it—I dare say the School Board spend 3s. per head per annum of the whole population in education. In Sheffield here it comes to something like 2s. per head, it may be a trifle over—280,000 is the population, to £30,000 per year, so that will be about it. What do you suppose they spend in Massachusetts? Fifteen shillings per head for the whole population. I had sent me a few days ago the last French enactment on education. It is the largest—I was going to say the most lavish—thing that has ever been done in the history of the education of the world, and it goes from the elementary school up to the university, and makes the elementary schools the third grade schools, and the second grade schools nearly all free, and gives art instruction, and science instruction, and school education in all three. And so, throughout Europe this is going on, and as Englishmen of the future will have to compete with all these nationalities, and will have to hold their own in the race—and, I hope, too, will have to share the dignity and prosperity of our great empire—I hope that Englishmen will receive the same amount of education, or, if possible, a higher education than that given in any other country of the world. There is one thing you are expecting of me, and everybody is urging it, and I shall do my best to carry it out. That is to say, as average attendance is the basis of the Code, I say that School Boards and School Attendance Committees shall do their duty. (Loud Cheers.) I am resolved, at the risk of any unpopularity which may attach to my labours, that if any of them are recalcitrant I shall use the power which Parliament has vested in me—and I will co-operate with you teachers in that—to insure that children shall come into your schools. (Cheers and cries of "Magistrates.") Oh! they are not in my Department. (Laughter.) But I have got a screw for them. If you are wise, you can help me in that. We will ask the Archbishop of Canterbury and the whole bench of bishops to put the screw upon the magistrates to do their duty in all the rural districts of England. When the magistrates are told that the poor parson is sacrificing his little earnings, or a considerable portion of them in order to maintain the school; that the teachers are there; that the school buildings are there, and waiting for the scholars, and you, the magistrates, are not doing your duty, I think if the National Society and the Bench of Bishops would do their duty they could show the magistrates that in the interests of the schools, in the interests of education, aye, and in the interests of labour—perhaps that would come home to them as soon as most things—in the interests of labour, they could show that the child should go early to school and regularly to school, and should continue at school till he has passed the standard of exemption. Let me beseech you, my friends, before I sit down, to take courage for the future. Don't be discouraged or daunted. Don't believe that you are mere 'pass grinders,' I beseech you. Let me ask you to consider who you are, and what are your duties; that on you devolve the most important duties that can devolve upon any class of Englishmen; that the formation of the national character is in your hands—that the destinies of the English people will be greatly swayed by the principles and conduct inculcated in our elementary schools, and believe me, Englishmen in the long run are not unjust. They will recognize good services, and if I do injustice, somebody will come after me who will recognize all the good service you do. But if I do you injustice, if my successors are unjust to you depend upon it the Arnolds, the Lancasters, the Pestalozzis, and all the educationists of the past have worked for something higher than mere State reward, and that the noblest reward you can have is the esteem and affection of those that you are training in paths of virtue, and the reward of a good conscience. (Loud and prolonged cheering.)

The Hon. E. L. Stanley, M.P., proposed the toast of 'The National Union of Elementary Teachers,' which was replied to by the President, who briefly indicated the object of the Union—the advancement of the education of the country, the promotion of the educator's interests, and the establishment of funds for the amelioration of the condition of distressed teachers, and their orphans. Other toasts followed and were replied to, the proceedings terminating with that of 'The Chairman.'

WEDNESDAY.

The Fourth Session was held on Wednesday afternoon, when the Executors for the ensuing year were chosen, and a long discussion held on the Compulsory Annuity Fund. The President having announced that the poll for the place of next Conference had resulted in favour of Newcastle-on-Tyne. Messrs. Birkby and Traill thanked the meeting for their goodness in selecting that town, and promised the Union a hearty welcome next year. Mr. Maidment moved :—

'That the subscription to the Union shall not be less than 5s. per annum.'

He said the Union had done good work, but had not accomplished nearly what it could have done had there been a larger subscription. Mr. Chambers seconded the resolution, which, after a long discussion, was carried. The Conference adjourned after the transaction of business respecting the alteration of Rules.

THURSDAY.

The Fifth Session was held on Thursday, and was commenced by Mrs. Burgwin reading a paper for Miss Muller, who was obliged to be absent, entitled 'Over Pressure in Schools.' A vote of thanks having been accorded to Miss Muller for the paper, Mrs. Burgwin moved :—

'That this Conference is of opinion that great injury has been inflicted upon teachers and scholars by the over-pressure of work under the Education Code, particularly in girls' and mixed infant schools; that no relief is afforded by the New Code just issued; and that it is desirable, in the interests of education, that the curriculum in elementary school should be less diffuse, or that the standard of examination adopted by many Inspectors should be reduced.' She looked at the question from a practical point of view—that is, from her own experience. The subject was a difficult one and, to some extent, unwelcome. At first sight it would seem that we argued for idleness, or wished to teach that moral doctrine of the Catechism—contentment. But the question was to what extent should we intensify the struggle of life. At present we have merely succeeded in driving laughter from our playgrounds—playgrounds no more, but drill grounds and places for reading lessons, weather permitting. We are driving mirth from our schools. Should we substitute ambitious industry for cheerful work? Was it worth while to attain to the state of mind of the old Roman, who found nothing to wonder at? Over-pressure had chiefly been brought about by teachers themselves; those who worked for percentages were the cause of the raising of the Standard of Examination. It was similar to the struggle between armour plates and heavy guns. Each in turn was increased in weight, until the ship at last sunk from the weight of what was intended for her protection. With regard to needlework, the Department acted from statements of teachers themselves, and specimens of work they had sent to the Department. The Needlework Schedule could not be worked in school hours. Until forced, she would never work the scheme. If all mistresses had refused to work it, it would not have been retained. Infants' school had ceased to be the delight it formerly was. It was now the blot on our educational system. She would not allow a child of hers to attend an infant school.'

Mr. Grove seconded the resolution. He endorsed what Mrs. Burgwin had said in respect to over-pressure, and especially with regard to what she had said on the needlework question. Mistresses and pupil teachers were ruining their health by taking home work to cut out and fix, and he feared a great deal of what was said to be done by children was really done in part by others. Specimens of this work sent to the Department was the ground upon which the Department went in fixing the work that was to be exacted from the children. Teachers had themselves to thank for several of the most obnoxious regulations of the Code.

After some discussion the resolution was amended and carried. Mr. Greenwood was again elected Treasurer. A long discussion on the Code followed, Mr. Grove expressing his regret that the subject should come on at such a late hour. He moved that the Report be received, which, after some discussion, was carried. Mr. Grove then proceeded to move further resolutions respecting the Code, all of which were carried. Votes of thanks to the Rt. Hon. A. J. Mundella, Miss Mundella, the Mayor, the Master Cutler, and the Inhabitants of Sheffield, were accorded on the motion of Mr. Foster. Mr. Odell moved :—

'That the best thanks of the Conference be given to the various sub-committees of the Local Conference Committee for their excellent and successful arrangements.'

The resolution having been seconded by Mr. Smith, was carried unanimously.

Annual Meetings of the Teachers' Benevolent Fund and the Teachers' Provident Society were held during the week.

EDUCATIONAL EXHIBITION.

The Educational Exhibition in connection with the Conference was held in the Cutler's Hall. The following firms were represented, the books, etc., mentioned, being those to which special prominence is given by the publishers' representatives :—

Messrs. Bemrose and Sons (rep. Mr. Chadwick). New Code Copy Books, College Copy Books, Ruins's Registers, New Ed. Code, Bemrose's Readers, etc.

Messrs. Blackie and Sons (rep. Messrs. Nicol, Smith, and Castell.) Graded Readers, Geographical Readers, Shakspere and Milton Readers for Prospective Code.

Messrs. W. and R. Chambers (rep. Messrs. Durward and McHardy). Graduated Readers, Etymological Dictionary, New Test Cards, Geographical Readers, Elementary Physiography.

Messrs. Fletcher and Co. (rep. Mr. W. Fletcher). Improved Covered Rotary Bicycle, Fleet Double Rotary, etc.

Messrs. Gall and Inglis (rep. Mr. W. R. Mellor). Map of Europe, British Readers, Prize Selections.

Messrs. Gill and Son (rep. Mr. F. Gill). Physiological Diagrams, Historical Readers, Geographical Readers.

Mr. Joseph Hughes (rep. Mr. H. Scheurmier). Educational Works.

Messrs. Isbister and Co. (rep. Messrs. Heller and Skertchley). Natural History Readers, Geographical Readers, Historical and New London Readers.

Messrs. Longmans, Green and Co. (rep. Mr. Greenway). Modern Series, Science Text Books, etc.

Messrs. Moffatt and Paige (rep. Messrs. Cautley and Heasman). Maps, Natural History Charts, etc.

National Society (rep. Messrs. Meech and Burkenshaw). Map of Europe, Physical Geography, Reading Sheets, etc.

Messrs. Nelson and Sons (rep. Messrs. Kenworthy and Gibbs). Historical and Geographical Readers.

North of England School Furnishing Co. (rep. Messrs. Chapman and Glendenning). Comp. Class Register, Slate Boards, Patent Desks.

Mr. H. M. Passley (rep. Mr. A. H. Passley). Cheylesmore Tricycle, Coventry Rotary Bicycle.

Messrs. Redmayne and Co. (rep. Mr. W. May). School Furniture, Improved Hallamshire Desks.

Messrs. Slater (rep. Misses Wilkinson, Hastie, Harrison, Thompson, and Greaves). Griffith and Farran's Publications, Safes, Stoves, Pianos, and Harmoniums.

Messrs. W. Ward and Co. (rep. Mr. Mathew). Certificates, Copy Books, Atlases, etc.

Messrs. Walkington and Broscomb (rep. Mr. Halliday). Paragon Slates, Exercise Books.

Mr. W. Walker. Diagrams, Cabinet of Objects, Wollman's Cards.

Wesleyan Methodist Sunday School Union (rep. Miss Carr). Prize Books, Hymn Books, Sunday Letters, etc., Publications of Palestine Exploration Fund.

We cannot close our report without bestowing a well merited word of praise on the Local Committee, to whose labours the success of the Conference may chiefly be attributed.

THE FROBEL CENTENARY.

ON the evening of Wednesday, April 5th, a large company met in the hall of Stockwell College to celebrate the Centenary of Friedrich Fröbel, who is well known as the founder of that system of training little children which goes by the name of the *Kindergarten*. The large hall of the college had been decorated for the occasion, and on a side-table were exhibited numerous interesting relics of Fröbel: autograph letters and copies of his earliest publications, together with photographs of the places where his life was spent, and a splendidly illuminated album, designed by Miss Kate Ashley, which was intended for transmission to Fröbel's widow.

The proceedings were opened by Mr. W. Woodall, M.P., who pointed out that the Kindergarten was but one feature of the great humanitarian movement of our time, which was so conspicuous in England in the growth of our numerous Sunday-schools. He dwelt on the pathos of Fröbel's early life, when the child recoiled from the drudgery of school life and sought in vain for help to interpret to him the phenomena of nature to which he was irresistibly drawn. A happy accident finally led him to adopt the scholastic profession, and here he met with Pesta-

lozzi, who gave him his life's impulse. His philosophical mind gave Pestalozzi's system that moral and religious tone which it had hitherto lacked, and transformed it from the mere study of natural objects—useful though that was—to a valuable ethical training of the infant mind. Through great opposition Fröbel struggled on and at last saw the institution of the first real *Kindergarten* at Blankenburg. This was in 1850, and two years afterwards the great reformer died at the age of seventy. Speaking then of the increased appreciation of Fröbel's system, Mr. Woodall remarked upon the clause in the new code which insisted on efficient infant teaching and made the grant depend upon the use of improved methods, which could mean nothing else than the practical adoption of Fröbel's system. Our great want was that of trained teachers, and for such there was great scope, for he had seen the Kindergarten system at work under circumstances the most disadvantageous and had never known it to fail of success.

Miss Manning, one of the Vice-president's of the Fröbel Society, then read a letter from Miss Shireff, the President of that Society, regretting that health would not allow her to be present, and congratulating her fellow-workers that they were able to celebrate the centenary with thankfulness for their past success and a good hope for the future. Miss Manning said that she had herself been attracted to Fröbel by his efforts to secure a rightful training for children, where their faculties would have due scope. Fröbel had shown that underneath the apparent wilfulness and naughtiness of children there was a flow of energy and desire for work which only needed proper cultivation to become a valuable factor in future life.

Mr. T. M. Williams, the Chairman of the Committee of the Fröbel Society, thanked the authorities of the college, in the name of the meeting, for their hospitality.

Mr. Woodall then called on Fräulein Heerwart, the highly-esteemed principal of the Stockwell Kindergarten College, who expressed her gratification at meeting so many disciples of Fröbel.

Mr. Langler, the ex-president of the National Union of Elementary Teachers, also expressed his great sympathy with the movement. The formal proceedings which had been agreeably diversified by vocal and instrumental music were terminated by a vote of thanks to the Chairman, moved by the Rev. H. Bourne. The meeting was then transformed into a conversazione, which was brought to a close by an impromptu dance in the tea-room, happily suggested by Fräulein Heerwart.

The programme—a work of art, by the way, and well worthy of the occasion—was designed and printed by Messrs. John Walker and Co.

It is a pleasure to add that the offices of the Fröbel Society are at No. 8, John Street, Adelphi, where all information respecting Kindergarten training may be obtained.

Publications Reviewed.

*** We are sorry to disappoint the many friends who desire us to quote the price of each work noticed in our columns. This we would respectfully point out is the publishers' duty and not ours; we give publicity enough to a book when we review it. Our readers should peruse the advertisements in our pages, and failing to find the price here, it would be no great trouble or expense to drop a line to the publishers whose name and address we will gladly give.

Geographical Readers for Elementary Schools. By Charlotte M. Mason. Book II. **The British Empire and the Great Divisions of the Globe.** London: Stanford.

This book is much to our taste. It is readable, and conveys much information in a most pleasant manner, together with a due amount of explanation on the *rationale* of geographical details. Maps are also judiciously referred to, and made the basis of several lessons, instead of being left, as is often the case, to general or accidental use. The most salient points are noticed in a necessarily rapid glance over Europe, and, what is more to the purpose, seldom noticed without judicious explanations. We have now many 'geographies' in which the formerly neglected elucidation of the causes and effects of physical and other influences were neglected. In these the tendency was rather to dwell on the *rationale* of physical geography, and to ignore political details. But these are a welcome relief from mere compilations of names and figures. In the book before us we have these two opposites avoided with the most obviously useful result. In this pleasing way we have the origin of some great physical features indicated. Speaking of the North Sea and its shallowness, the authoress remarks: 'At one time, before "history" began, there were no British isles, and no North Sea; but the continent stretched into the ocean a good way beyond the furthest coast of Ireland.' The low-lying land that extended from the eastern shores of England to Holland—'hollow land'—is supposed to have sunk at the slow rate of a few inches yearly, until the present sunken bed of less than 200 feet in depth was formed, and into which the waters of the Atlantic rushed, and thus formed the shallow sea by which Great Britain was cut off from the Continent. 'In the same way,' the authoress observes, 'the ocean may have rushed into another hollow bed on the west, and so made another sea, cutting off the island which we call Ireland.' The nature and advantages of commerce are thus treated, and also the reasons for the carrying on of mining operations in the northern districts, agriculture in the south, and so on. In an imaginary journey round the British coast, the authoress gives a graphic sketch of the most interesting features, often helping us to understand the meaning of local names, as in the following: 'No cape upon the east coast stands out to sea so boldly as Flamborough Head. A lighthouse rises from its cliffs of white chalk; and upon these cliffs, in ages long gone by, the Danes kept up huge bonfires to light their black ships over the stormy sea. Thus this cape came by its name, the headland of the *flame*.' In this way we might gratify ourselves and, we believe, also our readers by quotations from this well-written book, of whose usefulness we cannot entertain a doubt.

The First Historical Reader. By the Rev. D. Morris. London: Isbister.

Mr. Morris commences with the old fallacies about the Britons: that they were almost savages, did not know how to read and write, or build fine houses; that they lived 'in round huts of wood and mud,' and similar errors that have been so entirely refuted by Nicholas, Pike, Huxley and others as to be discarded by scholars. We are next introduced to Hengist and Horsa, who, we are told, 'seized on Kent and settled there.' This is a rather misleading way of representing the struggle for Kent which was carried on for twenty years before this corner of the country was wrested from the Britons. With all 'history to unlearn' we are not surprised to be told that the Britons 'were forced to find shelter among the mountains in the west of the island, where the English did not come to follow them.' We may, however, follow Mr. Morris with more pleasure through the succeeding chapters of his book, which contain a commendable admixture of leading historical features with a glance at the social condition of the people. The style is altogether commendable in being adapted without apparent effort for young readers. Another useful feature is the well-written summary at the end of each chapter, which, with a few leading dates and a selection of words for spelling exercises, will make the book additionally useful for schools. The illustrations are, besides being remarkably good, numerous and appropriate, and contrast favourably with mere collections of wood-cuts introduced without relevance to the subject-matter. We could have wished for other maps in addition to the useful one opposite to the title-page. The printing, too, is excellent, the type

gratifyingly large, and the paper good. This *First Reader* carries beginners down to the Norman rule under Stephen.

The Second Historical Reader. By the Rev. D. Morris. London: Isbister.

This book carries us down to the days of Elizabeth, and is written on the plan of the First Reader, but in a style suitably advanced to be adapted to the medium school standards. The clear and useful map of early France was to do duty for the entire book, but the other illustrations are as numerous and good as those in the First Reader. Among these we must fairly include a fac-simile specimen of Caxton's printing. This with a well-executed wood-cut of Caxton's Printing Office in Westminster, are valuable helps to the two useful chapters on the introduction of printing into England. Our readers will infer from these remarks that Mr. Morris's book wisely treats of the social matters as well as leading political occurrences. The pretty little view of Mr. Harcourt's islet in the Thames between Wraysbury and Egham is associated with the enforced signature of John to *Magna Charta*, or as our author has it *Magna Carta*. (We suppose we shall next have *Magner Carter*.) But we would rather air our superior learning by scolding little boys into the proper pronunciation of *Charta* than coin a new word for this purpose. *Charter* we know and *Charta* we know, but what is *Carta?* We don't recollect to have met with it in the dialects which Mr. Morris reduces to three as prevalent in England in the Plantagenet times. The leading events of our history from the Normans to the Tudors are told by Mr. Morris with more graphic details and less of the dull compendium of facts that form the staple of most of our school books on history. We are glad to mention in this particular a capital account of the destruction of the 'combined fleets of France and Spain,' as the later phrase has it, by Edward III., who commanded the *Cog Thomas*, and his son the Black Prince. This battle —not half enough recorded—won for Edward the name of King of the Sea, and besides securing England from invasion paved the way for the future maritime efforts of the English. The real difficulty, that of enforcing the laws in former times, is thus well stated by Mr. Morris: —'In those times, however, it was very difficult to get these laws obeyed, and at the end of the reign of Edward III. another Parliament complained that abuses still went on. This Parliament, which met in 1376, tried to improve the government of the king as well as to lessen the power of the [Pope] Bishop of Rome. The House of Commons condemned unjust taxes, and the waste of public money. They insisted that there should be a meeting of Parliament once every year, and that the people should be free to send there the members they liked best, instead of being compelled to send men chosen by the king. And because they tried to bring about so many improvements they were called ever after "The Good Parliament."' Wise words these, temperately expressed, but teem with materials that cannot be otherwise than beneficial in developing thoughtfulness in young readers. For matter of this kind we would willingly sacrifice some of the facts and figures of which most school books are made up. Such judicious remarks—wisely limited as they are in the book before us—are most appropriate in Reading Lessons. While regretting that Mr. Morris has stumbled at the threshold in repeating worn-out errors about the Britons and Saxons, we cannot too highly praise the judgment and care shown in the general narrative.

Geography Reading Books. Part IV. Adapted to Standard V. of the New Code. London: National Society.

In this book the author takes his young readers in a pleasing chatty manner over Europe. After a well-written sketch of the principal water-partings of Europe, the countries of Europe are graphically described under the guise of letters from a French lady to her sister, giving an account of her travels with her sons. Knowledge is not only more readily obtained by this descriptive gossip, but that also of the kind most worthy to be retained. Speaking of the climate of the Douro valleys, the author in the mouth of one of the youthful tourists, says, "How hot it was! Not a breath of wind, and the sun's rays beating into the valley, and coming back to you from the side of the hills." "I don't think it could be hotter in Africa," observed Adolphe. "Right! my young friend," said Mr. Campbell; "I know them both. The summer heat in those valleys on the Douro is tropical. Yet, in winter, you will find—what you will find nowhere else in Portugal—ice thick enough to bear a man." "And this," added M. Santul, "is the secret of the cultivation of the vine. It needs both the winter's cold and the burning heat of summer."'

The illustrations of this book are good, and the wee map of the physical features of Central Europe most useful, because restricted to its professed object. The printing is also good, the binding strong, and the entire 'get up' of the book most commendable.

Lectures on Plants. By Elizabeth Twining. London: William Poole.

The outside of this book gave us hopes. When we read 'Lectures on Plants . . . . . Twining, our thoughts reverted to the early work of Charles Darwin on 'Climbing Plants.' But turning to the perusal of the book we found that it was made up of four common-place lectures on plants by a writer equally ignorant, apparently, of botany and of English.

We do not hesitate to characterize this book as one of the worst we have ever read. The tone of it is most unhealthy, and the way in which religious matters are wantonly dragged into the book, and the glibness with which they are discussed, cannot but shock the mind of every religious person. The 'intentions of the Creator' are spoken of in a way painful to those who believe 'His ways' are 'past finding out' (pages 7, 25). That strange arrogance of humanity that finds expression in such statements as 'all things' in creation being ordered in reference to his (man's) temporal good' (p. 38), is also sadly evident here. Very thoughtless, also, must be an author who can write as Elizabeth Twining writes on p. 26: 'True knowledge of all the best things for man to know, is to be attained by all who desire to learn.' This is the very reverse of the truth. She might as accurately write, 'Food is to be attained by all who are hungry.' There is an intellectual starvation as common in our midst as is, alas! bodily starvation. Hundreds of young men and maidens are hungering and thirsting after knowledge, and from want of time, of opportunity, of money, perhaps of all, never reach it.

The unhappy carelessness of which we shall have to complain in other connections, presently, the writer even extends to her Biblical quotations. 'In the beginning' we are told on p. 41, God 'made the trees and the herbs.' But we read that 'in the beginning God created the heavens and the earth.' Not till the third 'day' after the beginning was a plant made. On p. 26 a still more unpardonable blunder is committed. 'Consider the lilies of the field how they grow,' was advice given to the disciples and other humble friends of the Saviour 'as they walked along.' If the authoress will turn to Matt. vi. 28, she will find the passage she quotes in a certain Sermon on the Mount and at the beginning of that sermon in the fifth chapter she will read: 'And seeing the multitudes He went up into a mountain; and when he was set,' etc.

The style of writing of this little book is deplorable. No young person ought to be allowed to read it, or his grammatical constitution will be undermined. Such slipshod English it has never been our misfortune to read outside the exercises of a composition class. Instances of this loose writing occur on pp. 2, 4, 5, 10 (here is a sentence absolutely destitute of either noun or verb), 11,

12, 14, 16, 23, 27, 29, 34, 42, 49, 97, 68, 69, 72. This is tolerably bad for a book of only eighty-six pages. One or two instances are as follows: On p. 23 we have, 'everything in the world is divided into three *portions:* animal, vegetable, and mineral.' And six pages beyond, the sun's light is in the midst of a dark earth.

More grave almost than these are the botanical blunders. On page 24 we are told that plants 'cannot move themselves from one place to another bodily.' Every botanist knows that the lower plants are constantly performing such a movement of translation. P. 42, 'The only source of anything for a plant is the dark earth in which it grows.' So that the plant takes nothing from the air, and insect-eating plants are unknown! To talk of 'breathing out oxygen' as an act of a plant, in the year 1878, shows a plentiful lack of the most elementary botanical knowledge. We should like to know what evidence the authoress has that stomata are breathing pores. On the same page that she makes the above unfounded assertion (p. 45), she actually writes of 'decomposing the air,' the most outrageous blunder we remember ever to have met with in a book professing to deal with science. The rhizoma or stem of ginger becomes the root. Finally, as far as our patience, not our supply of errors, is concerned, terms used in classification are inextricably concerned, the order Chenopodiaceœ becomes, on p. 70, a class.

We close the review and the book with a sigh of relief that we have seen the last of the latter.

Blackie's Graded Readers. Parts I. and II. Primer, First, Second, Third, Fourth, and Fifth Readers. Edited by Maurice Paterson, B.A. London: Blackie and Son, 49, Old Bailey, E.C.

We have examined this new set of Reading books with care, and we feel, that the highest praise we can give them is to say, that judged from any practical teacher's stand-point they will bear the strictest scrutiny and come well out of the ordeal. As any teacher can have copies upon application to the publishers, it is unnecessary to enter minutely into the contents and merits of each volume. Suffice then, that Mr. Paterson sets out, with what we have always held to be the first aim of an editor, viz., that of making his reading books *interesting*. Unfettered by any special 'method' he presents two bright-looking, attractively illustrated booklets as primers. Little folks will delight to thumb these pleasant books. Of the other volumes we can speak in like terms, they are carefully graduated, not too difficult, and provided with every kind of help either the scholar or teacher could reasonably desire. Clad in the same garb as the 'Comprehensive Readers,' printed in excellent style on good paper —slightly toned to preserve the eyesight—and bound in a style to stand rough school wear, Blackie's Graded Readers should prove favourites wherever adopted.

We give Mr. Paterson a special word of praise for the conscientious way in which he has done his work, and for the healthy and invigorating tone of his reading book.

Maria Wuz, and Lorentz Stark. English Prints of two German Originals. Longmans.

The first of these two life-like sketches concerns, not a woman (as we English might suppose), but a man, the name Maria being epicæne, as in Carl Maria Von Weber and the like. And the simple hero of these pages is but a cheerful, kindly dominie and organist in Auenthal, probably a real character in a true place, whereto the graphic genius of Jean Paul Richter has given immortality by his exquisite word-painting. There is nothing of a plot, and scarcely an incident that could interest a reader; one is reminded in the style of our Goldsmith's 'Vicar of Wakefield,' and of Toppfer's 'Voyages en Zigzag'—all simplicity and cheerfulness, with a subtle vein of humour throughout. We have the climax of the good man's happiness twice over, once in his gladsome wedding, and secondly, at a bound of many intervening years, in his peaceful death. The translation is done by a master hand, and the sketch dedicated very suitably to Thomas Carlyle.

'Herr Lorentz Stark,' by J. J. Engel, is (to tell plain truth) a prolix and prosy record of middle-class German home-life, with far too much detail of uninteresting conversation, and nothing of incident to compensate. The whole story concerns a mild form of quarrel between Herr Stark the elder and his son, because the latter falls in love with a good-looking widow much older than the son, objectionably enough burdened with debts and a couple of ready-made children; which state of domestic affairs is quite enough to enlist a rational reader's sympathy on the old man's side rather than his son's; but this is not the result intended by the author. Clearly J. J. Engel is not to be compared, as a word-painter, with J. P. Richter.

Philip's Series of Map-Drawing Books. No. 2 England and Wales, No. 22 Australia. With Instructions. By J. Francon Williams, F.R.G.S. London: Geo. Philip and Son, Fleet Street.

Mr. Williams has done a good service in publishing this series of Map-Drawing Books. Each book contains (1) a complete Full-Coloured Map, so attached as to be always available for copying; (2) an Uncoloured Map without the names, which the pupil can fill in as an introductory exercise; (3) an Outline Map, with coast-line and lines of latitude and longitude only—the pupil being required to fill in the mountains, rivers, towns, etc., with the names; (4) Map with lines of latitude and longitude only; (5) a blank sheet, with border of Map only. They will prove invaluable to the young learners, and are well worthy the consideration of every teacher of 'Mapping.' The books are issued in two sizes at threepence and sixpence each.

Cassell's Book of Sports. Part I. London: Cassell, Petter, Galpin and Co.

This is a new serial of the famous firm in La Belle Sauvage Yard. It fully maintains the reputation of the house, and is sure to be widely read. The printing has been done in splendid style.

Preparations for Science Teaching. By John Spanton. London. Griffith and Farran.

The former part of this book is so excessively simple and prolix in dialogues on the common properties of matter that teachers who are worth their salt will skip or laugh at the first half of the book. The latter part is, however, open to no such objection. The author warms to his work, gives good explanations, and capital suggestions for lessons. The lists of objects recommended to be provided for each lesson will also be serviceable. The lessons on the Senses will also be valued. The list of books recommended at the end 'may be of service,' as the author says, if 'beginners' could command some twenty years to master them. Such lists are too extensive to be of practical value.

The Bicycle Road Book. By Charles Spencer. London: Griffith and Farran.

This is a new and revised Edition (with Map) of a book which we commended to our readers nearly a year ago. We can now only endorse our former good opinion of the work, which is issued at a shilling,—half the original price.

Thrift.—No. 1. London: National Thrift Society.

We hail the appearance of this excellent periodical with pleasure. It is calculated to do much towards the cultivation of habits of thrift and economy, and has our heartiest wishes for its success.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question.* We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. IVANHOE.—$\frac{1}{17} = .05882\frac{6}{17}$; carry out to 20 places by multiplication.

$\frac{1}{17} = .05882\frac{6}{17}$,
$\therefore \frac{6}{17} = .05882\frac{36}{17} \times 6$
$= .35294\frac{1}{17}$;
$\frac{7}{17} = .05882\frac{6}{17} \times 2$
$= .11764\frac{14}{17}$;
$\frac{13}{17} = .35294\frac{1}{17} \times 2$
$= .70588\frac{4}{17}$.
$\therefore \frac{1}{17}$ to 20 places $= .05882352941176470588$.

2. YELSERP.—A and B set out from the same place in the same direction. A travels uniformly 18 miles per day, and after 9 days turns and goes back as far as B has travelled during those 9 days; he then turns again, and pursuing his journey, overtakes B at the end of $22\frac{1}{2}$ days after the time they first set out. Show that B uniformly travelled 10 miles a day. (*Barnard Smith.*)

A can walk in $22\frac{1}{2}$ days as far as B can walk in
$\{22\frac{1}{2} + (9 \times 2)\}$ days, or $40\frac{1}{2}$ days;

$\therefore$ B's rate per day $= \frac{18 \times 22\frac{1}{2}}{40\frac{1}{2}}$ miles

$= \frac{\overset{2}{\cancel{18}} \times \overset{5}{\cancel{45}}}{\underset{1}{\cancel{81}}}$ "

$= 10$ miles.

3. ROSEBUD.—If a snail, on the average, creep 2 ft. 7 in. up a pole during 12 hours in the night, and slip down 16 in. during the 12 hours in the day, how many hours will he be in getting to the top of a pole 35 ft. high? (*Barnard Smith.*)

The snail advances at the rate of (2 ft. 7 in. – 16 in.), or 15 in. in every 24 hours, except the part left after the last day.

35 ft. $\div$ 15 in. $=$ 35 ft. $\div 1\frac{1}{4}$ ft. $= 28$.

As the snail creeps up 31 in. during the night, 30 in. remain after 26 days.

Time to creep up the last 30 in. $= \frac{30}{31}$ of 12 hours
$= \frac{360}{31}$ hours
$= 11\frac{19}{31}$ hours.
$\therefore$ Total time $= 26$ days $11\frac{19}{31}$ hrs.
$= 635\frac{19}{31}$ hours. Ans.

4. R. B.—A shopkeeper buys $\frac{1}{2}$ cwt. of tea at 4s. 2d. per lb., and mixes it with tea which cost him 2s. 11d. per lb. How much of the latter must he add to the former, that he may sell the mixture at 3s. 8d. per lb., and gain 20 per cent. on his outlay? (*Barnard Smith.*)

Cost price of mixture per lb. $= 3s.\ 8d. \times \frac{120}{100}$
$= \frac{6}{5}$ of 3s. 8d.
$= 3s.\ 0\frac{2}{5}d$

Difference between cost price of mixture and first kind
$= 4s.\ 2d. - 3s.\ 0\frac{2}{5}d.$
$= 1s.\ 1\frac{3}{5}d.$
$= 13\frac{3}{5}d.$

" " " " " second kind
$= 3s.\ 0\frac{2}{5}d. - 2s.\ 11d.$
$= 1\frac{2}{5}d.$

$\therefore$ Quantity of 1st kind : Quantity of 2nd kind $:: 1\frac{2}{5} : 13\frac{3}{5}$
$:: 5 : 40$
$:: 1 : 8$

$\therefore$ Quantity at 2s. 11s. $= \frac{1}{2}$ cwt. $\times 8 = \underline{4 \text{ cwt.}}$ Ans.

5. J. YOUNG.—I sold out of the 3 per cents. at 96, and invested the sum accruing in railway 5 per cent. stock, thereby increasing my income 50 per cent. What was the price of the railway stock?

£3 + 50% of £3 = £4½.

$\therefore$ Price of railway stock $= £96 \times \frac{5}{4\frac{1}{2}}$
$= £\frac{2}{9} \times 10$
$= \underline{£106\frac{2}{3}}$. Ans.

6. ST. BLOATER.—Any number of men can dig 20 feet (in length) of trench for the foundation of a wall, or build 9 feet (in length) of the wall, or fill up 85 feet of the trench after the wall is built, in a day of 10 hours. Find how many out of 1058 men must be employed day by day in building the wall, so that the remaining men may be just sufficient each day to dig for the next day's building, and to fill up after the preceding day's building the same length of trench.

To dig 1 foot $\frac{1}{20}$ (in proportion) of the men are required.
" build " $\frac{1}{9}$ " " " " "
" fill up " $\frac{1}{85}$ " " " " "

$\frac{1}{20} + \frac{1}{9} + \frac{1}{85} = \frac{340 + 153 + 36}{3060} = \frac{529}{3060}$

$\therefore$ There must be employed to build $\frac{529}{3060}$ of 1058 men.
$= \underline{680 \text{ men.}}$ Ans.

7. MAGISTER.—The interest on a sum at simple interest is £7, and the discount for the same time is £5 9s. 4½d. What is the sum?

Let S = Sum
R = Rate per cent.
I = Interest
D = Discount.

$$\text{Then } I = S \times \frac{R}{100}$$
$$D = S \times \frac{R}{100+R}$$
$$I \times \frac{100}{R} = S$$
$$D \times \frac{100+R}{R} = S$$
$$\therefore I \times \frac{100}{R} = D \times \frac{100+R}{R}$$
$$I \times 100 = D \times (100+R)$$
$$I \times 100 = (D \times 100) + (D \times R)$$
$$(I \times 100) - (D \times 100) = D \times R$$
$$(I - D) \times 100 = D \times R.$$
$$\therefore (£7 - £5\ 9s.\ 4\tfrac{1}{2}d.) \times 100 = £5\ 9s.\ 4\tfrac{1}{2}d. \times R$$
$$(£7 - £5\tfrac{7}{16}) \times 100 = £5\tfrac{7}{16} \times R$$
$$£1\tfrac{9}{16} \times 100 = £5\tfrac{7}{16} \times R$$
$$£^{1\,7\,6}_{1\,1\,2} = £^{1\,7\,6}_{1\,1\,2} \times R$$
$$4900 = 175 \times R$$
$$\therefore R = \tfrac{4900}{175}$$
$$= 28.$$
$$S = I \times \frac{100}{R}$$
$$= £7 \times \frac{100}{28}$$
$$= £25.$$
$$\therefore \text{Sum} = £25 \quad \text{Ans.}$$

8. C. S. E.—A rectangular tank is 37 ft. 5 in. 6 pts. long, 22 ft. 7 in. 8 pts. wide, and has a volume of 329 cub. yds. 21 ft. 273 in. Find by duodecimals the depth of the tank. (*Civil Service Exam.*, Nov., 1881.)

	ft.			
	37	5′	6″	
	22	7	8	
	824	1	0	
	21	10	2	6‴
	2	0	11	8
sq. ft.	848	0	2	2

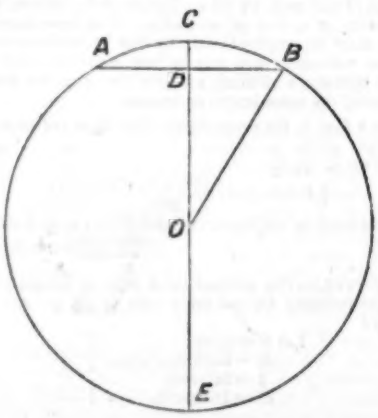
329 cub. yds. 21 ft. 273 in. = 8,904 cub. ft. 273 in.
= 8,904 cub. ft. 1′ 10″ 9‴

12	273
12	22 9
	1′ 10″ 9‴

sq. ft.		cub. ft.				
848	0′ 2″ 2‴)	8904	1′	10″	9‴	(10½ ft.
		8480	1	9	8	
		424	0	1	1	

∴ Depth of tank = 10½ ft. Ans.

9. ARETHUSA.—In a certain lake the tip of a bud of lotus was seen a span above the surface of the water. Forced by the wind, it gradualllly advanced, and was submerged at a distance of two cubits. Compute the depth of the water.—(*Barnard Smith.*)



Let AB represent the surface of the water, and OC the lotus; then at B the lotus is submerged.

CD = a span = 9 in.; DB = 2 cubits = 36 in.

First Method—

AD = DB = 36 in.
CD × DE = AD × DB (Euclid, III. 35)
9 in. × DE = 36 in. × 36 in.
∴ DE = 144 in.
CE = CD + DE = (9 + 144) in. = 153 in.
OC = ½ of CE = ½ of 153 in. = 76½ in.
∴ Depth of water (OD) = (76½ − 9) in.
= 67½ in.
= 5 ft. 7½ in. Ans.

Second Method—

$OB^2 = OD^2 + DB^2$ (Euclid, I. 47)
$= (OC - CD)^2 + DB^2$
$= (OB - 9)^2 + 36^2$
$= OB^2 - 18\ OB + 81 + 1296$
$18\ OB = 1377$
$\therefore OB = 76\tfrac{1}{2}$ in.
OD = OB − CD = (76½ − 9) in. = 67½ in. = 5 ft. 7½ in.
(Depth of water.)

10. G. JUMBO.—A cistern has 3 pipes, A, B, and C; A and B can fill it in 3 and 4 hours respectively, and C can empty it in 1 hour. If these pipes be opened in order at 3, 4, and 5 o'clock, when will the cistern be empty? (*Barnard Smith.*)

A can fill the cistern in 3 hours,
B ,, ,, ,, 4 ,,
C ,, empty ,, ,, 1 hour;
∴ At 4 o'clock ⅓ of the cistern is filled;
,, 5 ,, ⅓ + ¼ or 7/12 of the cistern is filled.
Part emptied in 1 hour when all the pipes are open
$= 1 - (\tfrac{1}{3} + \tfrac{1}{4}) = 1 - \tfrac{7}{12} = \tfrac{5}{12}$;
∴ Time to empty the cistern = $(\tfrac{7}{12} \div \tfrac{5}{12})$ hours.
= 7/5 hours.
= 2 hrs. 12 min.
∴ The cistern will be empty at 12 min. past 7.

11. GLACIER.—Given that the square root of 105,625 is 325, find that of 10,582,009, without going through the ordinary operation of finding the square root. (*Barnard Smith.*)

$325^2 = 105{,}625$,
$\therefore 3{,}250^2 = 10{,}562{,}500$;
10,582,009 − 10,562,500 = 19,509;
19,509 ÷ (3,250 × 2)
= 19,509 ÷ 6,500
$= 3 + \tfrac{9}{6500}$. (As the remainder (9) is the square of the quotient (3), it is an exact square.)
∴ Square root of 10,582,009 = 3,253.

12. CYMRO.—Arrange the digits 58,967,537 so that the number formed may be divisible by 19. (Scholarship Examination, 1880.)

Arrange the digits in pairs, divisible by 19.
Thus:—
58,967,537
57,896,753 (First pair divisible by 19).
57,389,675 (First and second pairs divisible by 19).
57,389,567 (First, second, and third pairs divisible by 19).
57,389,576 (Number divisible by 19).

13. SEDGEMOOR.—A person mixes 119 lbs. of coffee with 51 lbs. of chicory, the ratio of their values being as 1 : ½. By selling the mixture at 1s. 9d. per lb., he gains 5 per cent. Required the cost price of the coffee and chicory per lb.

Cost price of mixture per lb. = 100/105 of 1s. 9d.
= 20/21 of 1s. 9d.
= 20d.
Cost price of (119 + 51) or 170 lbs. of mixture.
= (170 × 20)d.
= 3400d.
Cost price of 119 lbs. of coffee + cost price of 51 lbs. of chicory = 3400d.
∴ Cost price of (119 × 7) lbs. of chicory + cost price of 51 lbs. of chicory = 3400d.
Cost price of (833 + 51) lbs. of chicory = 3400d.
,, ,, ,, 884 lbs. ,, = ,,
∴ Cost price of chicory per lb. = 3400/884 d.
= 3 17/221 d. = 3¾d. 1/13 q.
And cost price of coffee per lb. = 3¾d. 1/13 q. × 7.
= 2s. 2¼d. 9/13 q.

14. ALPHA, Tring.—A person buys tea at 6s. a lb., and also some at 4s. In what proportions must he mix them, so that selling his tea at 5s. 3d. a lb., he may gain 20 per cent. on each lb. sold?

Cost price of mixture per lb. $= \frac{120}{100}$ of 5s. 3d.

$$= \left(\frac{5}{5} \text{ of } \frac{21}{4}\right)\text{s.}$$

$$= 4\tfrac{2}{4}\text{s.}$$

Difference in price between mixture and first kind $= 6\text{s.} - 4\tfrac{2}{4}\text{s.}$
$= 1\tfrac{2}{4}\text{s.}$

" " " " second " $= 4\tfrac{2}{4}\text{s.} - 4\text{s.}$
$= \tfrac{2}{4}\text{s.}$

$\therefore$ Quantity of 1st kind : Quantity of 2nd kind $:: \tfrac{2}{4} : 1\tfrac{2}{4}$
$:: 3 : 13.$

15. ALPHA, Carlisle.—£25 0s. 8d. was collected after a sermon; the bags contained a certain number of sovereigns, twice as many half-sovereigns, six times as many crowns, nine times as many half-crowns, twenty times as many shillings, and the number of fourpenny pieces was equal to the number of all the rest of the coins. What number of half-crowns did the bag contain?

			£	s.	d.
Suppose the No. of sovereigns	= 1, then value	=	1	0	0
Then " " half-sovereigns	= 2, and "	=	1	0	0
" " " crowns	= 6, " "	=	1	10	0
" " " half-crowns	= 9, " "	=	1	2	6
" " " shillings	= 20, " "	=	1	0	0
" " " fourpences	= 38, " "	=	0	12	8
			£6	5	2

£ s. d. £ s. d. Half-crowns.
$\therefore$ 6 5 2 : 25 0 8 :: 9 : No. of half-crowns.
$\therefore$ No. of half-crowns $= 9 \times 4$
$= 36.$ Ans.

16. QUÆSITOR.—Suppose 5 candidates are examined for two scholarships, and that A obtains $\frac{3}{7}$ of the whole number of marks given; B twice as many as A gets more than C, who obtains 3 times as many as B gets more than D; that D obtains $\frac{1}{5}$ as many as A, B, and C together, and E $\frac{1}{3}$ more than the excess of the sum of A, B, and C's marks over D's. Determine the successful candidates.

Let the letters representing the candidates stand for the fraction of the whole number of marks obtained by them, respectively.

$$\left.\begin{array}{l} A = \frac{3}{7} \\ B = 2(A - C) \\ C = 3(B - D) \\ D = \frac{1}{5}(A + B + C) \\ E = \frac{1}{3}(A + B + C - D) \end{array}\right\}$$

$E = \frac{1}{3}(2D - D)$
$= \frac{1}{3} D.$

$B = 2(A - C)$
$= 2(\frac{3}{7} - C)$
$= \frac{6}{7} - 2C.$

$C = 3(B - D)$
$= 3(\frac{6}{7} - 2C - D)$
$= \frac{18}{7} - 6C - 3D$
$7C = \frac{18}{7} - 3D$
$\therefore C = \frac{18}{49} - \frac{3}{7}D.$

$D = \frac{1}{5}(A + B + C)$
$= \frac{1}{5}(\frac{3}{7} + \frac{6}{7} - 2C + C)$
$= \frac{1}{5}(\frac{9}{7} - C)$
$= \frac{1}{5}\{\frac{9}{7} - (\frac{18}{49} - \frac{3}{7}D)\}$
$= \frac{1}{5}\{\frac{45}{49} - \frac{18}{49} + \frac{3}{7}D\}$
$= \frac{1}{5}(\frac{27}{49} + \frac{3}{7}D)$
$= \frac{27}{245} + \frac{3}{35}D$
$D - \frac{3}{35}D = \frac{27}{245}$
$\frac{32}{35}D = \frac{27}{245}$

$$\therefore D = \frac{3}{7} \times \frac{\cancel{35}}{32} = \frac{6}{11}.$$

$C = \frac{18}{49} - \frac{3}{7}D$
$= \frac{18}{49} - \frac{3}{7}$ of $\frac{6}{11}$
$= \frac{18}{49} - \frac{18}{77}$
$= \frac{132 - 90}{385}$
$= \frac{42}{385}$
$= \frac{6}{55}.$

$B = \frac{1}{5} - 2C$
$= \frac{1}{5} - \frac{12}{55}$
$= \frac{44 - 12}{55}$
$= \frac{32}{55}$

$E = \frac{1}{3}D$
$= \frac{2}{3}$ of $\frac{6}{11}$
$= \frac{4}{11}.$

The number of marks obtained by the candidates $= \frac{3}{7}, \frac{32}{55}, \frac{6}{55}, \frac{6}{11}, \frac{4}{11}$, respectively, of the whole number of marks.
$\therefore$ The successful candidates are B and E.

Algebra.

1. J. T. BROWN.—A number consists of two digits; their sum is 13, and their product is 34 less than the number. What is that number?

Let x = digit in tens' place,
And y = " " units' " ;
Then $10x + y$ = the No.

$$\left.\begin{array}{l} \therefore (1)\quad x + y = 13 \\ (2)\quad xy + 34 = 10x + y \end{array}\right\}$$

(1) $x + y = 13$
$\therefore y = 13 - x.$

(2) $(13 - x)x + 34 = 10x + 13 - x$
$13x - x^2 + 34 = 9x + 13$
$-x^2 + 13x - 9x = 13 - 34$
$x^2 - 4x = 21$
$x^2 - 4x + (2)^2 = 21 + 4$
$= 25$
$x - 2 = \pm 5$
$\therefore x = 7$ $\qquad y = 13 - x = 6$
$\therefore$ No. $= 76.$

2. NIL DESPERANDUM.—The product of two numbers equal to 6 times their sum, and the sum of their squares is 325. Find the numbers.

Let x = one No.,
And y = the other;

$$\left.\begin{array}{l} \text{Then,}\quad (1)\quad xy = 6(x + y). \\ (2)\quad x^2 + y^2 = 325 \end{array}\right\}$$

(1) $xy = 6(x + y)$
Squaring, $x^2y^2 = 36(x + y)^2$
$= 36(x^2 + 2xy + y^2)$
$= 36(2xy + x^2 + y^2)$
$= 36(2xy + 325)$ $\{x^2 + y^2 = 325\ (2)\}$
$= 72xy + 11{,}700$
$x^2y^2 - 72xy = 11{,}700$
$x^2y^2 - 72xy + (36)^2 = 11{,}700 + 1{,}296$
$= 12{,}996$
$xy - 36 = \pm 114$
$xy = \pm 114 + 36$
$\therefore xy = 150.$

(1) $150 = 6(x + y)$
$\therefore x + y = 25.$

$$\left.\begin{array}{l} (2)\quad x^2 + y^2 = 325 \\ 2xy = 300 \end{array}\right\}$$

$x^2 - 2xy + y^2 = 25$
$\therefore x - y = 5$
$x + y = 25$
$2x = 30$
$\therefore x = 15,$ and $y = 10.$
$\therefore$ The numbers are 15 and 10.

3. BEAN-STALK.—Solve— $\frac{x - 7}{5} + \frac{x + 1}{11} = \frac{2x - 7}{3} - 11.$

$$\frac{x - 7}{5} + \frac{x + 1}{11} = \frac{2x - 7}{3} - 11.$$

L. C. M. = 165
$33(x - 7) + 15(x + 1) = 55(2x - 7) - (155 \times 11)$
$33x - 231 + 15x + 15 = 110x - 385 - 1{,}815$
$33x + 15x - 110x = 231 - 385 - 1{,}815$
$48x - 110x = 231 - 2{,}215$
$-62x = -1{,}984$
$\therefore x = 32$

4. ALGEBRA, Enfield.—Find two consecutive numbers such that the half and the fifth of the first taken together shall be equal to the third and fourth of the second taken together. (*Todhunter.*)

Let x = first number,
Then $x+1$ = second ,,

$$\therefore \frac{x}{2}+\frac{x}{5}=\frac{x+1}{3}+\frac{x+1}{4}$$
$$\frac{7x}{10}=\frac{7(x+1)}{12}$$
$$\frac{x}{10}=\frac{x+1}{12}$$
$$6x=5x+5$$
$$\therefore x=5$$

∴ Nos. are 5 and 6.

5. SCHOLARSHIP.—A and B start to run a race: at the end of 5 minutes, when A has run 900 yards, and has outstripped B 75 yards, he falls; but though he loses ground by the accident, and for the rest of the course makes 20 yards a minute less than before, he comes in only half a minute behind B. How long did the race last?

A runs 900 yds. in 5 min., and outstrips B by 75 yds.;
∴ B runs 825 yds. in 5 min.
∴ B ,, 160 ,, per min.,
And A ,, 180 ,, ,, before accident.
Let x = time race lasted in minutes,
Then $165x$ = length of course in yards.
A runs 165 yds. per min. after accident,
And $165x-900$ = No. of yds. A has to run after accident;
Then $\frac{165x-900}{160}$ = time it takes him.

$$\therefore \frac{165x-900}{160}=x-4\tfrac{1}{2}$$
$$165x-900=160x-720$$
$$165x-160x=900-720$$
$$5x=180$$
$$\therefore x=36$$

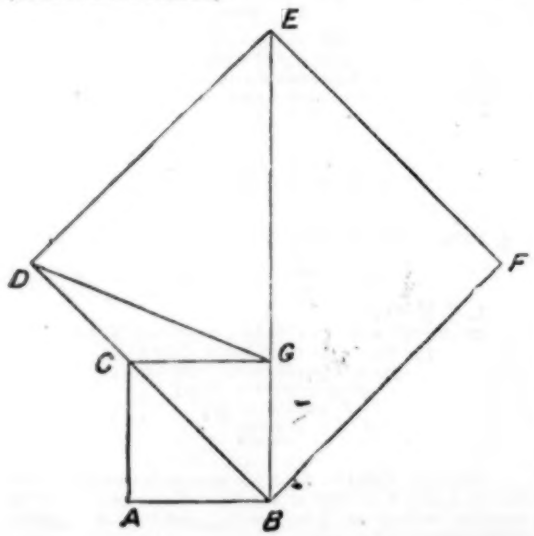
∴ Race lasted 36 minutes.

6. MATHEMATICUS.—Three flags are required to make a signal. How many signals can be given by 20 flags of 5 different colours, there being 4 of each colour?

No. of signals with 1 of a colour = 5. 4. 3
= 60;
,, ,, ,, 2 ,, = 3. 4. 5. (Two of one colour with one of the others will make 3 signals).
= 60;
,, ,, ,, 3 ,, = 5;
∴ No. of signals = 60+60+5
= 125. Ans.

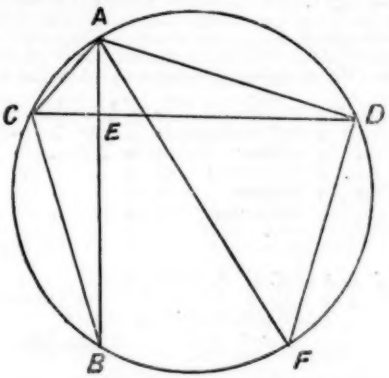
Geometry.

1. NORMAN.—Show how to describe a square, the difference between the lengths of a diagonal and a side being given. (*Hamblin Smith's* Euclid.)



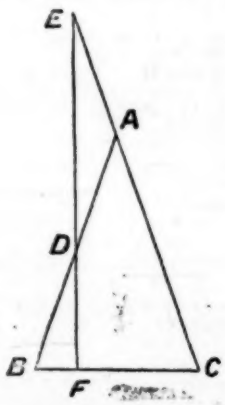
Let AB be the given difference.
Construction.—At A erect perpendicular AC = AB.
Join BC, and produce it to D, making CD = AB.
Then DB shall be the side of the required square.
Proof.—Construct the square DEFB. Join EB, and from C draw CG perpendicular to EB. Join DG.
AB = AC, ∴ ∠ ABC = ½ right angle;
∠ GBC = ½ right angle; ∴ ∠ ABG is a right angle:
wherefore ABGC is a square.
CG = AB, and CD = AB (con.), ∴ CD = CG (ax. 1);
wherefore ∠ CDG = ∠ CGD (i. 5).
∠ CDE = ∠ CGE = (ax. 11), ∴ ∠ EDG = ∠ EGD (ax. 3);
∴ ED = EG (i. 6).
Where BG, that is AB, is the difference between a diagonal, and a side of the square DEFB. Q. E. F.

2. T. B., Liverpool.—If two chords of a circle intersect at right angles, the sum of the squares on the four segments equals the square on the diameter.



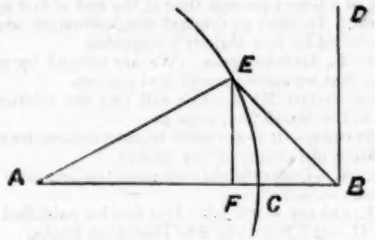
Let the chords AB, CD, intersect at right angles in E.
Then $AE^2 + EB^2 + CE^2 + ED^2$ = square on the diameter.
Draw the diameter AF, and join AC, AD, BC, DF.
Proof.—∠ ADF is a right angle (III. 31), and therefore equal to the ∠ AEC; also ∠ ACE = ∠ AFD (III. 21);
∴ ∠ CAB = ∠ DAF (I. 32);
wherefore arc CB = arc DF (III. 26),
and therefore chord CB = chord DF. (III. 29.)
$AD^2 = AE^2 + ED^2$ (I. 47),
and $CB^2 = CE^2 + EB^2$;
∴ $AD^2 + CB^2 = AE^2 + ED^2 + CE^2 + EB^2$ (ax. 2);
but DF = CB, and $AF^2 = AD^2 + DF^2$;
∴ $AF^2 = AE^2 + EB^2 + CE^2 + ED^2$.
When the chords meet without the circle, the property is proved in a similar manner. Q. E. D.
Note.—Writing fair, but rather too thick. It would pass at the Scholarship Examination.

3. ALASCO.—The straight line EDF, drawn at right angles to BC the base of an isosceles triangle, cuts the side AB in D, and CA produced in E; show that AED is an isosceles triangle.



Proof.—In the triangles EFC, DFB,
$\angle EFC = \angle EFB$, (ax. 11,)
and $\angle ECF = \angle DBF$, (I. 5,)
$\therefore \angle CEF = \angle BDF$, (I. 32.)
but $\angle ADE = \angle BDF$, (I. 15,)
$\therefore \angle AED = ADE$, (ax. 1,)
wherefore the triangle AED is isosceles. (I. 6). Q. E. D.

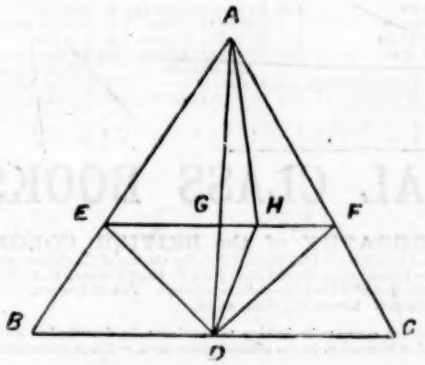
4. E. BRERETON.—Construct a right-angled triangle, having given the hypotenuse and the sum of the sides (*Todhunter's* Euclid).



Let AB be the sum of the sides, and AC the length of the hypotenuse.
At the point B erect perpendicular BD.
Bisect angle ABD by the straight line BE.
From the centre A, at the distance AC, describe an arc cutting BE in E.
Draw EF perpendicular to AB.
Then AEF shall be the triangle required.
Proof.—$\angle EFB$ is a rt. ang., and $\angle FBE$ is $\frac{1}{2}$ rt. ang.,
$\therefore \angle FEB$ is $\frac{1}{2}$ rt. ang.; (I. 32).
wherefore FE = FB (I. 6).
$\therefore$ AE, EF are together equal to AB, and AE = AC;
also $\angle AFE$ is a rt. ang.
Q. E. F.

5. ECCLES.—A watch-ribbon is folded up into a flat knot of five edges; show that the sides of the knot form a regular pentagon.—(*Potts'* 'Euclid.')
Describe an isosceles triangle having each of the angles at the base double of the third angle (IV. 10), and upon a line representing a fifth part of the ribbon describe a triangle similar to it. The method of folding the ribbon is now apparent from IV. 11.

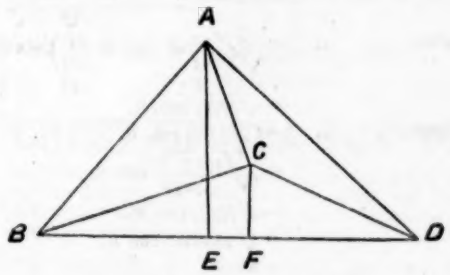
6. FIDUS ACHATES.—The straight line drawn from the vertex of a triangle to the point of bisection of the base bisects any line parallel to the base, and terminated by the sides, or the sides produced. And conversely, any line so bisected is parallel to the base.



In the triangle ABC, let the straight line AD bisect the base BC.
Draw EF parallel to BC, and cutting AD in G.
Then EF shall be bisected in G.
Join DE, DF.
Proof—$\triangle BAD = \triangle CAD$, (I. 36)
and $\triangle BED = \triangle CFD$, ,,
$\therefore \triangle ADE = \triangle ADF$ (ax. 3).
Now, if EF be not bisected in G, if possible let it be bisected in H, and join AH, HD.
Then $\triangle AHE = \triangle AHF$,
And $\triangle EHD = \triangle FHD$;
Wherefore quadrilateral AHDE is half the quadrilateral AEDF;
But the triangle ADE is half the quadrilateral AEDF;
Therefore ADE is equal to AHDE, which is absurd.
Wherefore EF must be bisected in G.
When the line is drawn parallel to the base and terminated by the sides produced, it is proved in a similar manner.
Conversely—Let AD bisect EF, BC.
Tnen EF shall be parallel to BC.
Proof.—$\triangle BAD = \triangle CAD$, (I. 36)
$\triangle EGA = \triangle FGA$, ,,
and $\triangle EGD = \triangle FGD$; ,,
$\therefore \triangle BED = \triangle CFD$; (ax. 3).
Wherefore EF is parallel to BC (I. 40).
Similarly when the line is terminated by the sides produced.
Q. E. D.

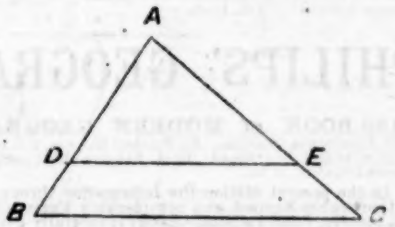
Mensuration.

1. IKV MO.—One diagonal of a quadrilateral which lies outside the figure is 70 ft., and the difference of the perpendiculars upon it from the extremities of the other diagonal is 16 ft. Find the area.



$$\text{Area of } \triangle ABD = \frac{BD \times AE}{2},$$
$$\text{,, } \triangle CBD = \frac{BD \times CF}{2};$$
$$\therefore \text{Area of quadrilateral } ABCD = \frac{BD \times AE}{2} - \frac{BD \times CF}{2}$$
$$= \frac{70 \times AE}{2} - \frac{70 \times CF}{2}$$
$$= 35 \times AE - 35 \times CF$$
$$= 35\,(AE - CF)$$
$$= 35 \times 16$$
$$= 560 \text{ sq. ft.}$$

2. NIL DESPERANDUM.—A person has a triangular-shaped garden, the base of which contains 200 yards, and divides it into two equal parts by a hedge parallel to the base; find the length of the hedge.—*Todhunter's* 'Mensuration.'



$\triangle ADE : \triangle ABC :: DE^2 : BC^2$ (Euclid, VI. 19.)
$\therefore 1 : 2 :: DE^2 : 200^2$
$2DE^2 = 40{,}000$
$DE^2 = 20{,}000$
$\therefore DE = \sqrt{20{,}000}$
$= 141{\cdot}42\ldots$
$\therefore$ Length of hedge $= 141{\cdot}42\ldots$ yds.

3. J. S. E. N., Shatto Heath.—If the perimeter of a semicircular flower-bed be 60 feet, how many plants will it contain, allowing one square foot for each plant?

Diameter + $\frac{1}{3}$ Circumference = 60 ft.
Diameter + ($\frac{1}{3}$ Diameter × 3·1416) = 60 ft.
Diameter + (Diameter × 1·5708) = 60 ft.
Diameter × 2·5708 = 60 ft.

$$\therefore \text{Diameter} = \frac{60}{2{\cdot}5708}\text{ ft.}$$
$$= \frac{15}{{\cdot}6427}\text{ ft.}$$
$$\text{Area of flower-bed} = \tfrac{1}{2}\{(\cdot 6\tfrac{1}{427}\text{ ft.})^2 \times {\cdot}7854\}$$
$$= \frac{225 \times {\cdot}3927}{{\cdot}41306329}\text{ sq. ft.}$$
$$= \frac{88{\cdot}3575}{{\cdot}41306329}\text{ sq. ft.}$$
$$= 213\frac{37,501,923}{41,306,329}\text{ sq. ft.}$$

$\therefore$ No. of plants = 213.

4. N. G. R.—The solid content of a sphere being $\frac{8}{21}$ of $\frac{343}{125}$ of a cube, the side of which is the radius of the sphere, and a cubic foot of iron weighing 450 lbs., find the diameter of a 68 lb. cannon ball.

Solidity of cannon ball = $\frac{88}{375}$ cub. ft.
$= \frac{352}{1500}$ cub. ft.

Radius " " $= \sqrt[3]{\left(\frac{7}{4}\text{ of }\frac{113}{343}\text{ of }\frac{\frac{17}{24}}{\frac{17}{75}}\right)}$ cub. ft.
$= \sqrt[3]{\frac{1921}{53250}}$ cub. ft.

Diameter " " $= 2\sqrt[3]{\frac{1921}{53250}}$ cub. ft.
$= \sqrt[3]{\frac{1921 \times 8}{53250}}$ cub. ft
$= \sqrt[3]{\frac{15368}{53250}}$ cub. ft.
$= \sqrt[3]{{\cdot}288600\ldots}$ cub. ft.
$= {\cdot}66\ldots$ ft.
$= 7{\cdot}92\ldots$ in. Ans.

General.

1. T. D.—Your query is solved in our last issue. See Pupil Teachers' Examination Questions, p. 93.

2. ANXIOUS ENQUIRER, W. H. S. B.—See replies to Nos. 25 and 26 in February part.

3. MARY.—(1st year.) To write from memory the substance of a passage of simple prose, read to them with ordinary quickness, or a short letter.

(2nd year.) To write full notes of a lesson on a subject selected by the inspector.

(3rd year.) To write a letter, or to write from memory the substance of a longer passage than at the end of first year.

(4th year.) To write an original composition on some simple subject selected by Her Majesty's Inspector.

4. E. P. T., Littlehampton.—We are obliged by your offer, and regret that we cannot accept it at present.

5. STICK-IN-THE-MUD.—You will find the solution of your problem in the March No., page 41.

6. A. SLOPER.—It is advisable to put a column for method in writing Notes of Lessons on *any* subject.

7. JUNIOR.—Under the old code pupil teachers must be bound for *two* years *at least*.

8. J. H., Orkney.—10s. 6d. Post free for published price.

9. W. H.—(1) No. (2) The Historical Books.

10. X. Y. Z., Hasland.—The Treaty of Wedmore was concluded between Alfred and the Danes. By its terms a large part of the land was given to the Danes for a settlement.

11. GRAMMARIAN.—Angus or Morris.

12. CETEWAYO.—Scripture Questions are not set at the Scholarship Examination by the Department, but by the authorities of the different denominational colleges.

13. SAIS.—See the previous numbers of this Journal for information.

14. ST. HELENA.—'How to Compose and Write Letters' (*Hughes*), 1s.

15. SOLWAY.—The solution you send is quite correct.

16. W. R.—We cannot see the method of solution of your query.

17. J. P. R., Glasgow.—I certainly think you have a very fair chance of success if you work. Todhunter's books are the ones generally used, but those by Deschanel, Ganot, and Balfour Stewart are also likely to prove useful.

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Dame Durden's work was done,
And she before her cottage door
Sat sewing in the sun,
And by her sported on the green
Her little grandchild Emmeline;

Who saw her sister Margaret
Pick up a 'piece of wire,'
That with some other rubbish
Was swept into the mire;
And ran at once, and made a fuss,
And asked her grandma what it was.

Dame Durden took it from the child,
Who stood expectant near;
And then the old dame shook her head,
And cried; 'This is, my dear,
A needle of the days gone by,
Before the new AGONIC EYE!

You'll find them in the garden,
There's many hereabout;
For when I come across them
I always sweep them out,
And *now*, the needle that I buy
Is Thomas's AGONIC EYE!

Those old ones were so badly made,
The eye so rough inside,
That oft to get my cotton through
A dozen times I've tried;
And then it cut the thread—for why,
It was not an AGONIC EYE!'

'But why did people buy them
When good ones they might get?'
'And what did people make them for?'
Cries little Margaret—
'Pray tell us both the reason why,
And of this new AGONIC EYE!'

'As for those common needles
They're made *to sell* no doubt;
But why folks buy them,' said the dame,
'I never could make out:
They won't again, if once they try
The famous new AGONIC EYE!

For they will find this needle
A boon to all who sew,
And thank *plain* SAMUEL THOMAS
(With neither "Sons" nor "Co.")
And every one will rush to buy
His famous new AGONIC EYE!

Look, children, at this needle,
How large the eye! How bright!
And how, within, it sparkles
Like a diamond in the light!
And this,' Dame Durden made reply,
'Is Thomas's AGONIC EYE!

And all the papers praise the man
Who gives us these instead [snapp'd,
Of those "old makes" which bent or
And fray'd or cut the thread.
And everywhere is now the cry—
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The Lady's Pictorial, June 4th, 1882.
The Tailor and Cutter, October 20th, 1881. [1st, 1881.
Weldon's Journal of Dress, Fashion, and Needlework, Nov.
Court Circular, January 21st, 1882.
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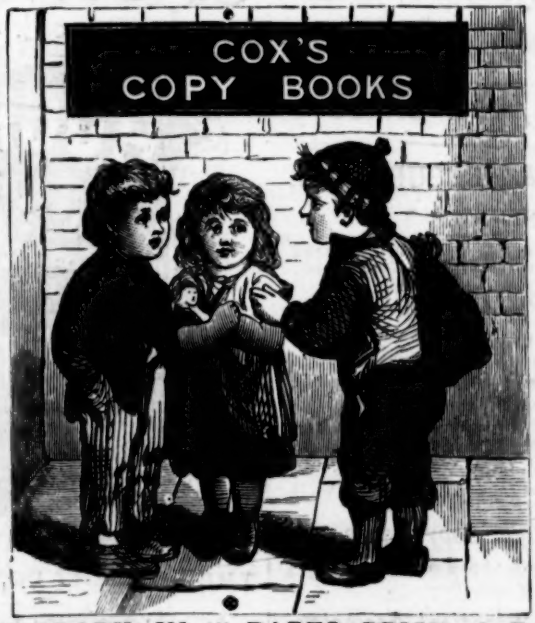

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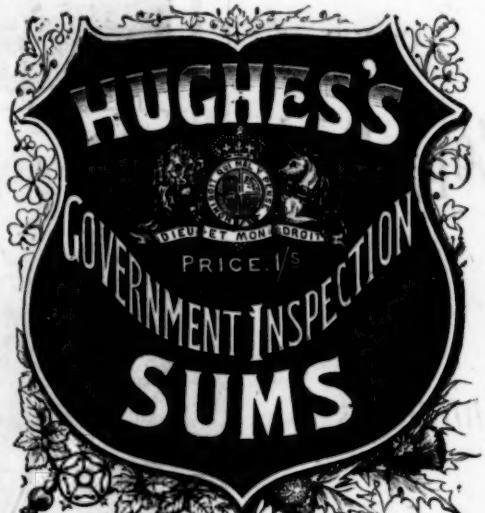

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